DECEMBER, 1929

Railway Engineering and Maintenance

An increase of only one month in the life of rail will save for your road the increased initial cost of Improved Hipowers.

THE NATIONAL LOCK WASHER COMPANY
Newark, New Jersey, U. S. A.

IMPROVED
HIPOWER

Greater rail joint protection

at a far lower cost per mile . . .

RAIL joint rigidity is obtained through HY-CROME at a far lower cost than by the frequent re-wrenching of track gangs. HY-CROME permanent non-fatiguing action prevents the costly low joints that permit battering of rail ends.

Time-tested and service-tested on all kinds of track in all parts of the country under all kinds of traffic, the great reactive pressure and wide reactive range of HY-CROME has always convincingly proved that it insures permanent rail joint security at the lowest cost per mile.

HY-CROME spring washers are made of the finest suitable grade of electric alloy steel. Every step in their making is under the vigilant supervision of competent engineers. Has your road made a HY-CROME TRACK-TEST? It will pay.

THE
RELIANCE MANUFACTURING CO.
MASSILLON, OHIO
Engineering Materials, Ltd., McGill Bldg.
Montreal, Quebec, Canada

HY-CROME

RAILWAY ENGINEERING AND MAINTENANCE
Published monthly by Simmons-Boardman Publishing Co., at 105 W. Adams St., Chicago. Subscription price: United States, Canada and Mexico, $2.00; foreign countries, $3.00 a year. Single copy, 35 cents. Entered as second class matter January 13, 1916, at the postoffice at Chicago, Illinois, under the Act of March 3, 1879
Alphabetical Index to Advertisers, Page 58 Classified Index to Advertisers, 54-56

How Long The 70,114,405 Treated Ties Last in Track

Depends on The Tie Plate

THE U. S. Forest Service reports that during 1928 70,114,405 ties were treated in the United States. These ties should last 20 years or more. But will they? Preservative treatment can only protect them against decay. Their life in track depends on how successfully tie plates protect them against mechanical destruction.

If a ribbed bottom tie plate is used, the sharp projections cut deeply into the wood fibres and thereby defeat the very purpose of treatment. Moisture enters the untreated wood — starts decay and rots the tie. The expected long life is not realized.

The Lundie Tie Plate has thoroughly demonstrated its ability to protect ties against mechanical wear. The bottom, with its series of rounded steps, in lieu of sharp projections, does not sacrifice tie life in holding track to gauge. The fibres are merely compressed—never cut. The Lundie Tie Plate absolutely assures maximum life and economies from treated ties.

The Lundie Engineering Corporation

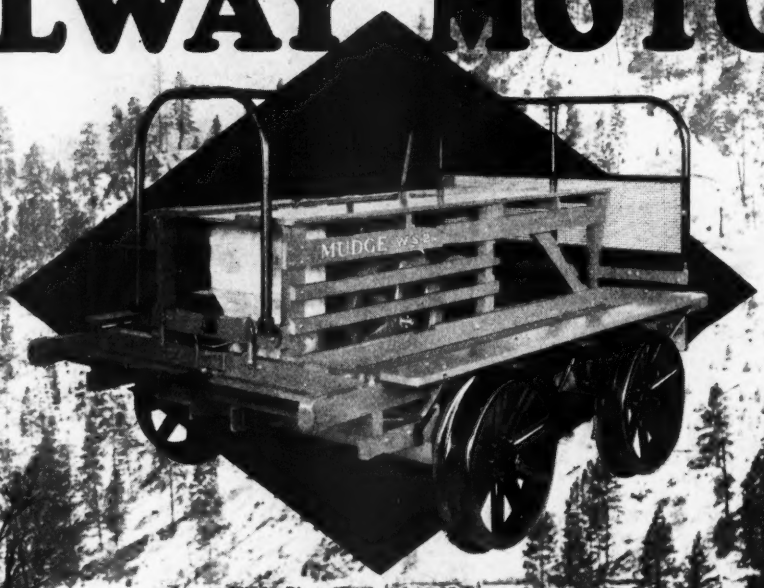
285 Madison Ave., New York

166 West Jackson Boulevard, Chicago

LUNDIE TIE PLATE

Fairmont

RAILWAY MOTOR



WS2—Bigger Engine, 8-12 H. P.
Seats ten men; housing tips up for servicing; Endless Cord Belt Drive

Performance *on the Job* Counts

E R A I L R O A D

AND Mudge CARS

Performance in all kinds of weather

Snows, rains, 40 below zero or 110 in the shade . . in all kinds of weather . . under the most trying conditions, Fairmont and Mudge Motor Cars have been serving steadily, faithfully, efficiently.

They are the minute men of the rails, always ready, never flinching, always anxious to serve.

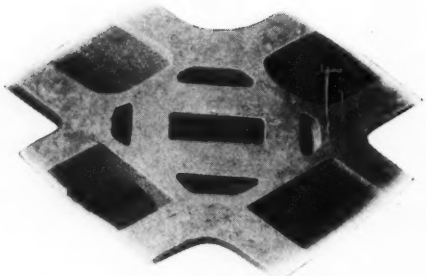
Today more than half of all the motor cars in use are Fairmont products. An appreciated tribute to "Performance on the Job."

FAIRMONT RAILWAY MOTORS, INC.
FAIRMONT, MINNESOTA, U. S. A.
General Sales Offices: 1356 Railway Exchange Bldg., CHICAGO
Foreign Representative: BALDWIN LOCOMOTIVE WORKS
District Sales Offices
New York City Washington, D. C. St. Louis San Francisco New Orleans
FAIRMONT RAILWAY MOTORS, Ltd., Toronto, Canada

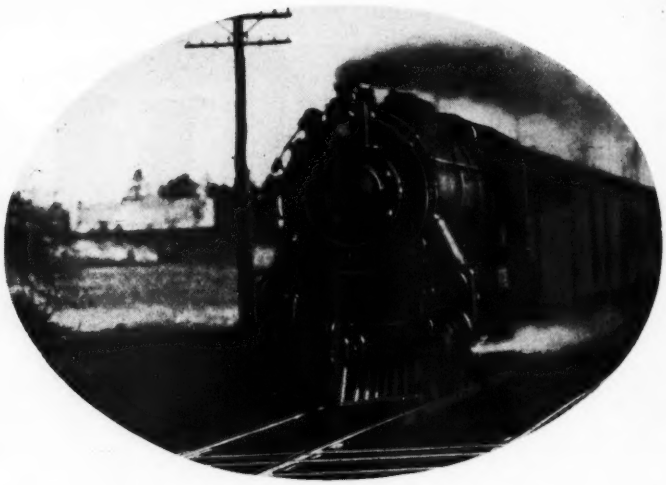
FAIRMONT AND MUDGE PRODUCTS

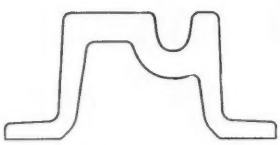
SECTION MOTOR CARS
A2—M2—S2—M14—WS2
INSPECTION MOTOR CARS
E14—C1—M19—MM9
WEED MOWERS AND DISCERS
M24—M23
WEED BURNERS
B(M27)—C(M27)
GANG AND POWER CARS
MT2—A4—A5
PUSH CARS AND TRAILERS
T1—T2—T3—T12—T20—T24—T25
ROLLER AXLE BEARINGS
Ringseald-Axlsaver—Bower—Hyatt—Timken
MOTOR CAR ENGINES
QB—PHB—PHA—QHB and W
WHEELS AND AXLES

WORLD KNOW



Botton View Under Intersection





Section Through Crossing

The WHARTON Scientifically Designed CROSSING Solves a Serious Problem

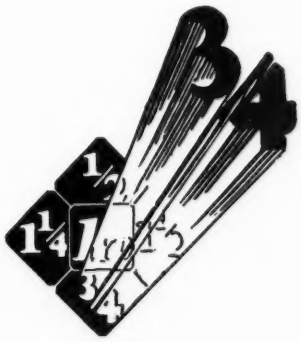
THE NEW WHARTON Scientifically designed Crossing has been installed in the tracks of over fifty of the leading steam and electric railway companies, with a phenomenal record of a small fraction of 1% of failures—due to defects, other than design.

Wm. Wharton Jr. & Co., *Inc.*

Easton, Pennsylvania

SALES OFFICES: Boston Chicago El Paso Houston Montreal New York Philadelphia Pittsburgh San Francisco Scranton

DIG THE DITCH *and* Elevate *the* Grade *in one Operation*



CUT the cost of raising sinking track from 25 to 50%. Eliminate hauling ballast or loading to a work train with a Northwest R. R. Special.

The Northwest crawler crane or dragline can be loaded completely erected on one flat car and unloaded ready to work at the job. It handles the material from the ditch to the grade leaving a neat ditch for drainage and placing the ballast where it can be easily shoveled under the jacked-up track.

Let us show you motion pictures of this machine! 16 railways are now using them and one has placed 33 on its lines! Ask about the special feature given at the left.

The Northwest R. R. Special brings features no other machine can offer. The tapered cab and rotating control assure safety to traffic. The patented steering method takes it where other machines can't travel. Scientific design assures greater capacity per unit of weight and cost. Crawler design permits crossing rail without jamming treads between the rollers.

NORTHWEST ENGINEERING CO.

The world's largest exclusive builders of gasoline, oil burning and electric powered shovels, cranes and draglines

1701 Steger Building 28 E. Jackson Boulevard
Chicago, Ill., U. S. A.

NORTHWEST

these Northwest features mean safety and capacity!

REM12-Gray

"THE
Top Note
IN
Rail Anti Creepers"

This quotation is from a letter written by a track man.

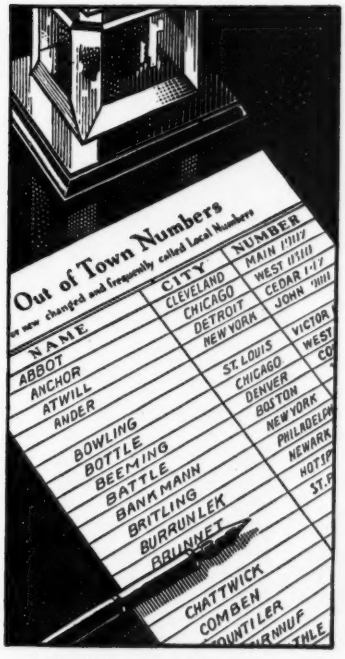
"Just as in the case of the Fair Anchors, you can hear nothing but the highest praise for them. Of course, you know how much we think of the Fair, so any praise we could make on them would merely be a repetition of universal acclaim They are the top note in anchors"

THE P. & M. CO.

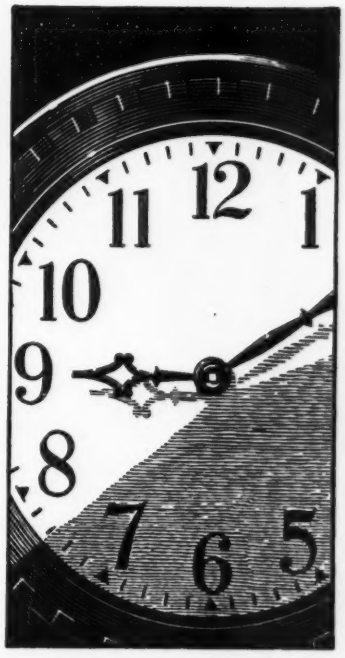
CHICAGO NEW YORK
MONTREAL LONDON PARIS
CALCUTTA SYDNEY

The FAIR Rail Anti Creeper

3 simple Suggestions for Telephoning between Cities



Call by number, whenever you can



Call during the less crowded hours of the business day

Speak distinctly and directly into the mouthpiece

Here are three simple suggestions that are almost sure to help you in getting the most out of your telephone calls between near and distant towns.

Call by number, whenever you can; it will save your time. It is useful to know the number, especially for calls that you may make frequently. "Information" will gladly give you the number of any person or concern you wish, so that you can make a note of it for the future. It is a convenience to your customers to print your own telephone number on your letterhead.

Make your calls when the men you want to reach are likely to be less busy. Try calling before 9.30 in the morning, between noon and 2, or shortly after 4.

Third, speak distinctly into the telephone, keeping your lips close to the mouthpiece. A natural speaking voice such as you use in talking to a man across your desk makes distant calls as clear as local calls.

Remembering these three points will make your telephone service easier and better than ever.

Inter-city calls are ideal for making appointments. Following up visits. Clearing away misunderstandings. Completing buying and selling transactions. Bell Telephone Service is *Convenient . . . Economical . . . Universal.*

SAFETY TOOLS
VERONALLOY

CHISEL

MAUL

SLEDGE

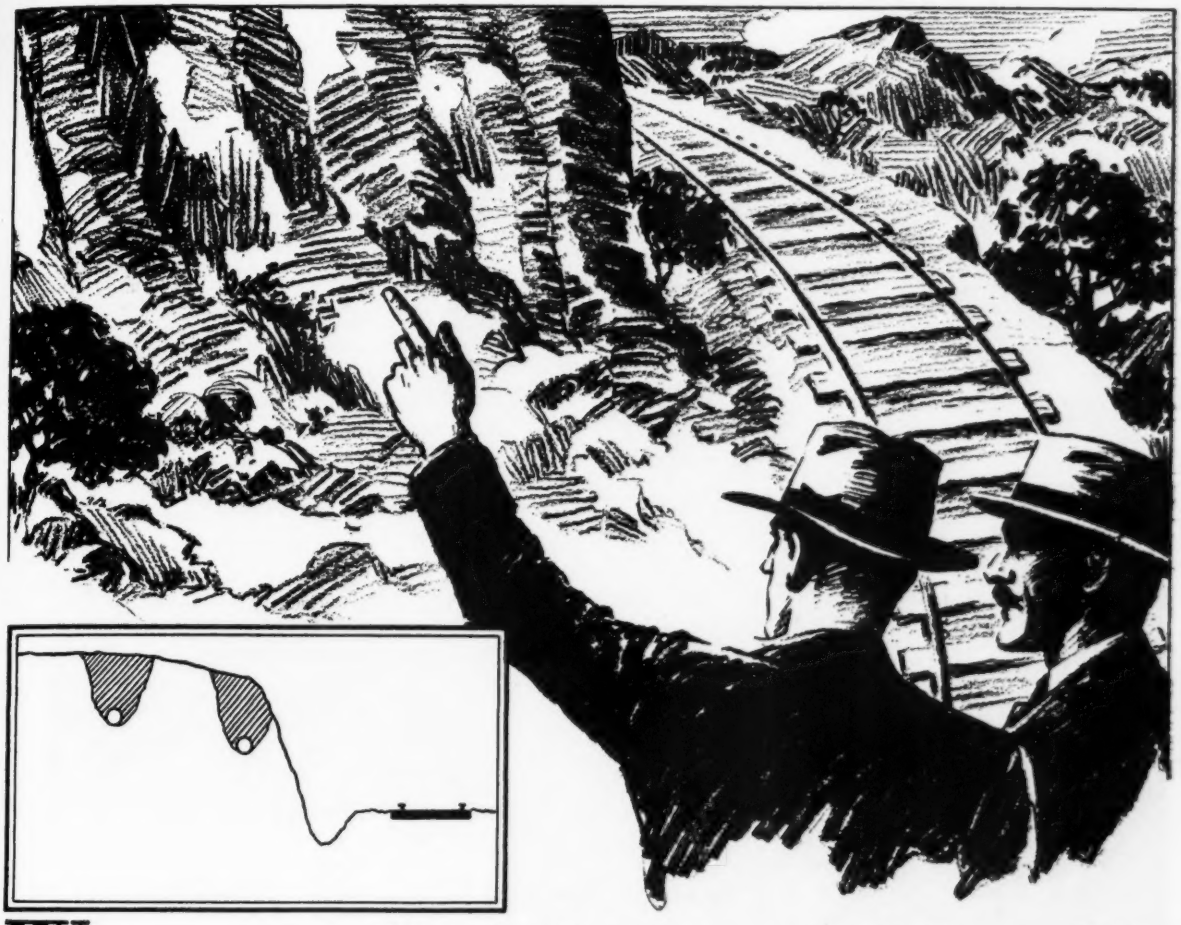
VERONALLOY

Tools are *safe* in design and structure. Forged from high grade non-shatter, non-flying alloy steel.

Painted VERONALLOY Green—the Symbol of *Safety* and Service.

VERONA TOOL WORKS, Pittsburgh, Pa.

Established 1873



We controlled this landslide with Armco Corrugated Subdrains

AN engineer, responsible for track maintenance in a mountainous region, estimates that landslides are directly, or indirectly responsible for about one-fifth of roadway maintenance expenses.

Under such conditions, this engineer, along with others confronted by landslide difficulties, has turned to Armco Perforated Iron Pipe . . . with results astonishingly successful.

After years of study and experiment, the control of landslides has been reduced to a practical basis, with ample engineering data and experience to assure satisfactory results.

Here, as in many other situations, the super strength and consistent endurance of the sturdy Armco flexible iron pipe solves track problems . . . safeguards perfect alignment . . . reduces repairs and replacements to a minimum . . . cuts maintenance costs to the bone.

No two landslide problems are exactly alike, but if you will advise us of the conditions you have to meet, we shall be glad to consult with you and give you the benefit of the experience we have gained on many different installations which are serving their purpose satisfactorily.

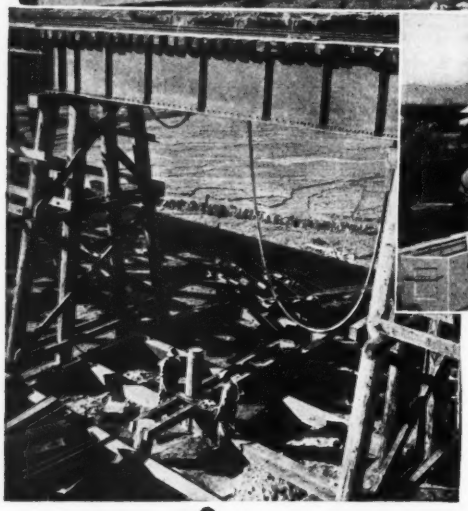
Write us.

ARMCO CULVERT MANUFACTURERS ASSOCIATION
MIDDLETOWN, OHIO

Armco culverts and drains are manufactured from the Armco Ingot Iron of The American Rolling Mill Company and always bear its brand

ARMCO ARMCO *perforated* PIPE

©1929, A.C.M.A.



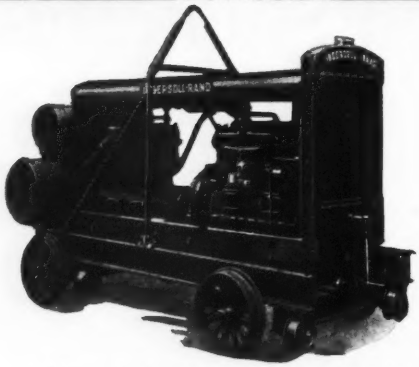
Speeding up Railway Timberwork

THE "WOLF" PORTABLE TIMBER SAWING MACHINE—Air or Electric Motor Drive (A. C. 110 and 220 volts, 60 cycle, 3 phase; D. C. 115 and 230 volts).

The Air Driven Type is shown above cutting 12-24" Oregon Pine on a Southern Pacific Railway bridge repair job, where a saving of 50% in labor is reported. L. E. Wissner, Bridge Supt., says the machine is "a splendid tool where rapid and accurate cuts are required."

For under-water cutting the air saw is most satisfactory. On one job recently, 100-12"x12" fir piles were cut 20 feet under water in 6 hours, all to Govt. specifications of not more than ½" variation above or below designated level. (Greiling Eng. Co. at Frankfort, Mich.)

Over 350 "Wolf" saws now serve the Railroad, Mining, Marine, General Construction and other fields in economically cutting heavy timber.

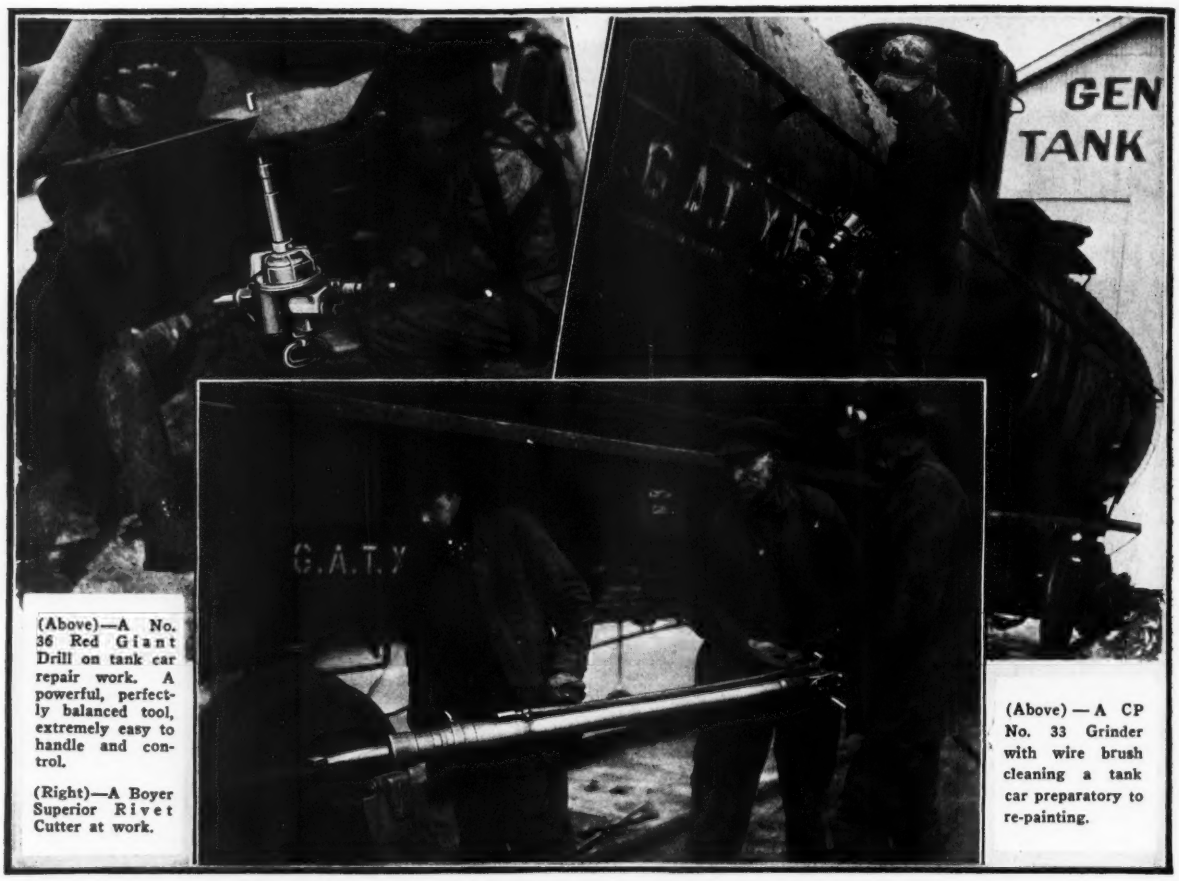


Above: A familiar sight on all lines—the Ingersoll-Rand Gasoline-Engine-Driven Portable Compressor mounted on flanged wheels. Equipped with cross-trucks and lifting bale. Can be furnished either with or without self-propelling mechanism. Three sizes available.

In use by Boston & Maine, New York Central, New York, New Haven & Hartford, Southern Pacific, Atchison, Topeka & Santa Fe, Chicago & Northwestern, Chicago, Burlington & Quincy, Southern, Chicago, Milwaukee & St. Paul, Maine Central, Union Pacific, Panhandle & Texas, Erie, Grand Trunk, Great Northern, etc.

REED-PRENTICE CORP'N, Worcester, Mass., U.S.A.

DEPENDABLE
Spike
and
Bolt
SERVICE



(Above)—A No. 36 Red Giant Drill on tank car repair work. A powerful, perfectly balanced tool, extremely easy to handle and control.

(Right)—A Boyer Superior Rivet Cutter at work.

(Above)—A CP No. 33 Grinder with wire brush cleaning a tank car preparatory to re-painting.

CP Pneumatic Tools Speed Up Repair Work

A CAR can't earn a profit while it is in the repair shop. The quicker it is put in good order, the quicker it becomes a profit earner. Such jobs as riveting, rivet busting, drilling, reaming, buffing, cleaning and wood boring—can be done QUICKLY, ACCURATELY and ECONOMICALLY with CP tools.

If you haven't a copy of our latest 84-page catalog of pneumatic tools (No. 562) we'll gladly send you one on request.

CHICAGO PNEUMATIC TOOL CO.

RAILROAD DEPARTMENT

6 East 44th St., New York
175 First St., San Francisco
310 So. Michigan Ave., Chicago
1004 Mutual Bldg., Richmond, Va.
Terminal Tower, Cleveland

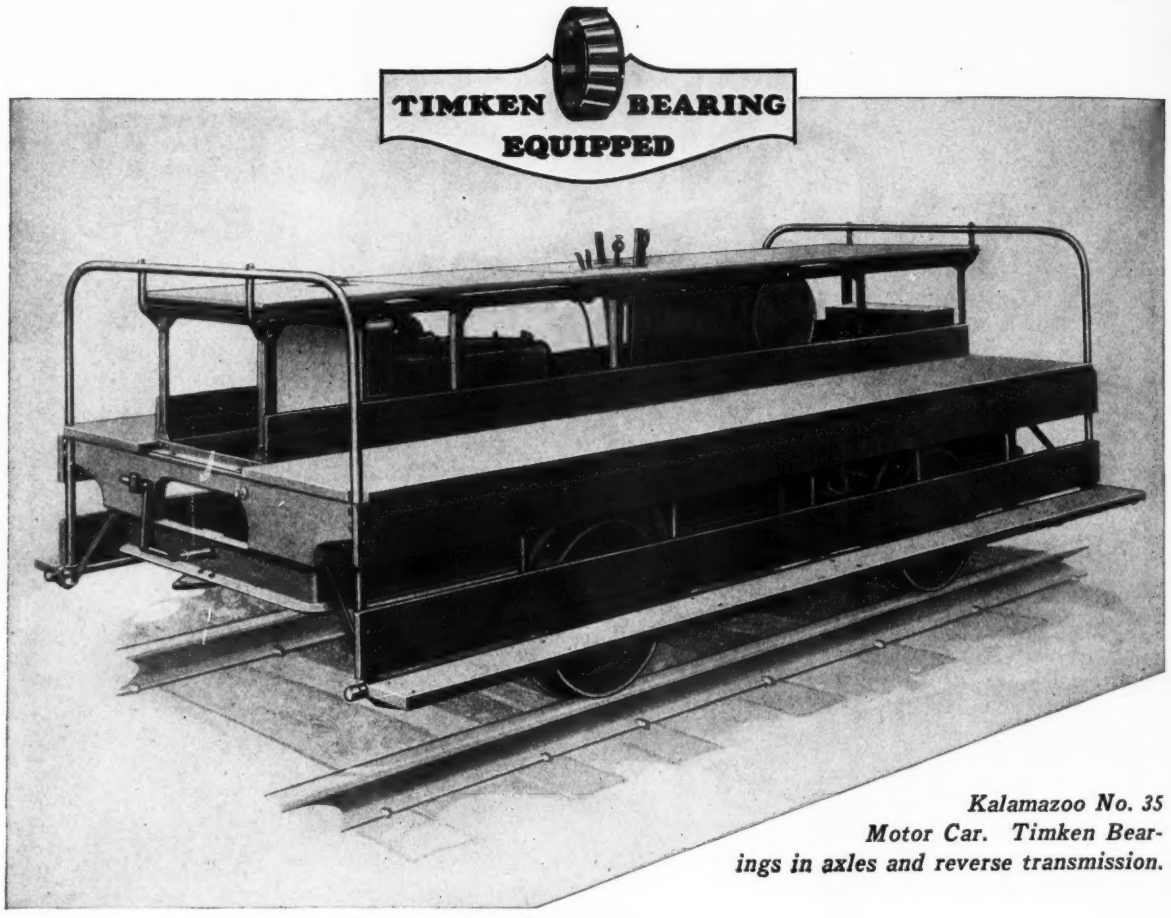
P-309

Sales and Service Branches all over the World

NOW! BIGGER-BETTER AND LOWER IN COST PER POUND

THE Woodings, Bigger and Better one piece Rail Anchor meets with the whole hearted approval of the Engineers.
It is equal to the ever increasing tasks brought about by faster and heavier traffic.
With the application of the Bigger and Better "Woodings" you meet this greater demand with a greater anchor.

WOODINGS FORGE & TOOL CO.
WORKS AND GENERAL OFFICES
VERONA, PENNA.



Kalamazoo No. 35 Motor Car. Timken Bearings in axles and reverse transmission.

Kalamazoo Motor Cars Feature Timken Advantages

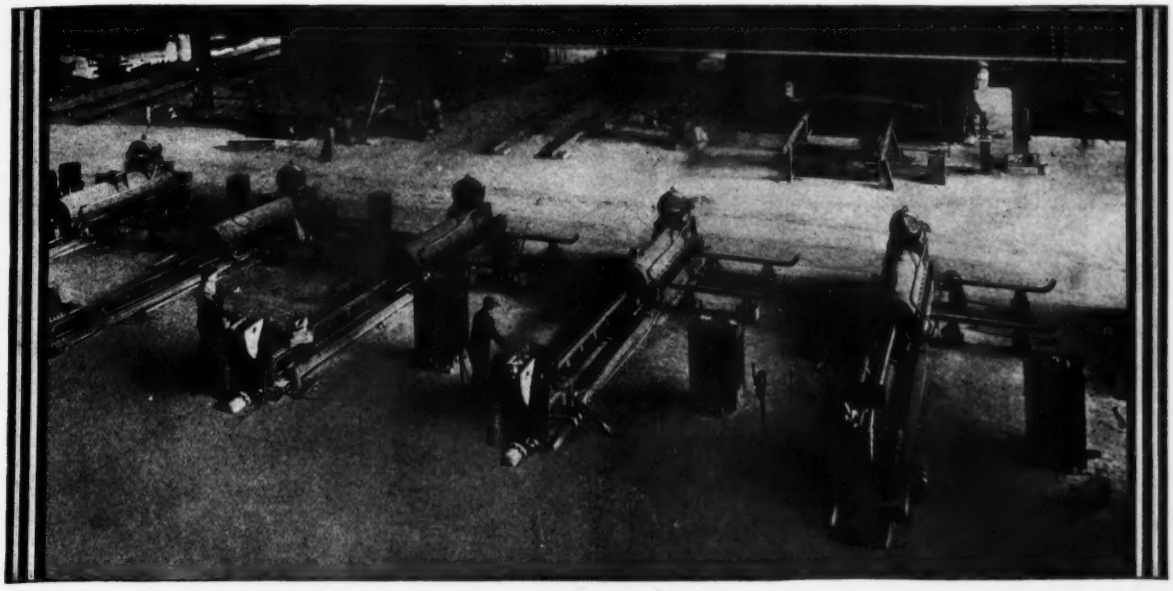
In railroad section motor cars where engine size is necessarily limited, and where speed, strength and endurance must be combined with compactness and light weight, Timken Bearings are not only desirable, but necessary for maximum operating efficiency and economy, as the Kalamazoo Railway Supply Company, builders of Kalamazoo section cars, were quick to appreciate.

By reducing friction to the vanishing point, Timkens extend motor power and save fuel and lubricant. Through their *dual load capacity* they carry *thrust* as well as *radial* loads with equal facility, thereby prolonging car life and cutting maintenance costs to the bone.

Timken Bearings alone can offer this unusual combination of advantages, for only in Timkens is found the exclusive combination of Timken tapered construction, Timken *POSITIVELY ALIGNED ROLLS* and Timken steel.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TIMKEN *Tapered Roller* **BEARINGS**



Centrifugal casting in these machines gives deLavaud pipe...

100% greater tensile strength
65% greater transverse strength
25% greater bursting strength

IN a series of strength tests on deLavaud Pipe, conducted by a disinterested testing laboratory, the results shown above represent the strength of deLavaud as compared with pit cast pipe.

While these percentages appear startling at first glance, a careful comparison of deLavaud metal with pit cast will help to convince you of their authenticity. For deLavaud Pipe metal will appear dense and extremely close-grained, while the structure of pit cast pipe metal will be coarse and crystalline.

deLavaud Pipe is made by pouring molten metal into a revolving cylindrical mould. Centrifugal force holds the iron against the mould and drives out slag and gas bubbles *with a force 40 times greater than gravity.* Thus deLavaud metal is dense and fine in structure. And, it is remarkably free from weakening impurities.

In addition, the action of the water-cooled deLavaud mould and the subsequent annealing further improve the physical properties and the microstructure of the metal.

Let us send you all of the facts and figures on deLavaud Pipe; also the deLavaud Handbook which gives useful information about types of joints and dimension tables.

Cast iron pipe made by this Company bears the "Q-check" trademark of The Cast Iron Pipe Research Association.

United States Pipe and Foundry Co., Burlington, New Jersey

Sales Offices: New York, Philadelphia, Pittsburgh, Cleveland, Buffalo, Chicago, Dallas, Birmingham, Kansas City, Minneapolis, Seattle, San Francisco, Los Angeles

Ingersoll-Rand Tie Tamper Compressor operating CC-250 Spike Drivers in rail-laying work.

The advantages of pneumatic spike driving

Better holding power of the spikes because of even and rapid driving.

Ties drawn up better to the rail.

Few "broken head" or "goose neck" spikes.

Less cost per spike driven.

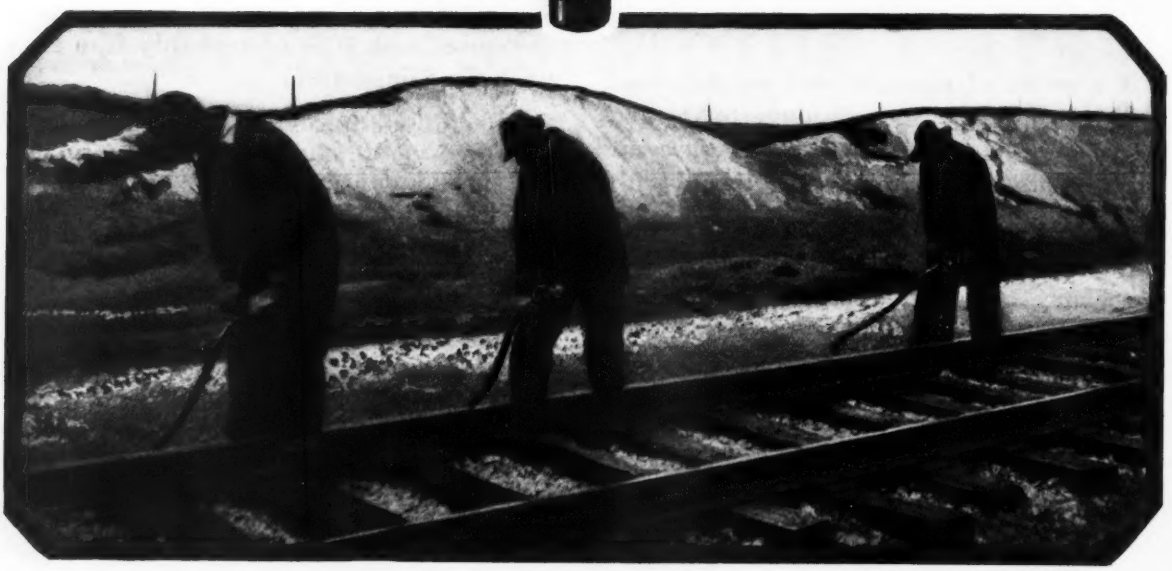
Faster driving; less fatigue to the workman.

The CC-250 Spike Driver

INGERSOLL-RAND CO., 11 Broadway, New York City

Branches or distributors in principal cities the world over

For Canada Refer—Canadian Ingersoll-Rand Co., Limited, 10 Phillips Square, Montreal, Quebec

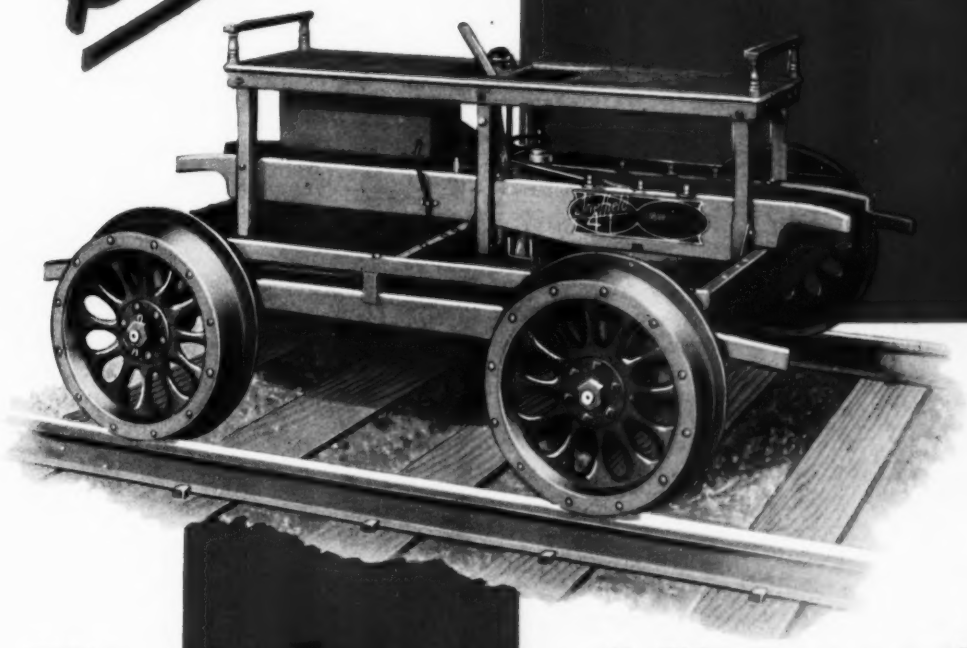


R-1978

Ingersoll-Rand

272-TT

"Sheffield 41"



The *class* of the road!

A centerload car that has become one of the taken-for-granted, reliable factors of railroading! For getting roadmasters, supervisors, linemen, etc., over the road, the "Sheffield 41" has demonstrated its class for over a decade.

Years of service have justified its sound design and construction. Not a single weakness or inadaptability has made necessary so-called "improvements." When you purchase a "Sheffield 41" you buy a time-tested, known quantity of dependable service unapproached by any other car in its field.

FAIRBANKS-MORSE

TIMKEN BEARING EQUIPPED

MOTOR CARS

FAIRBANKS-MORSE MOTOR CARS

FAIRBANKS-MORSE MOTOR CARS

"Sheffield 44B"

This one reason alone—

It's a great car—most railroad men know it is the best single-cylinder section car on the rails! It is built by a maker whose guaranty means something. Lightness is combined with strength—its huskiness makes no sacrifice to fuel and oil economy. These are all valid reasons for purchasing "Sheffield 44B's." But one reason stands above them all.

You can put this car on a section with greater assurance that it will stay out of the repair shop.

The clutch cannot be burned out:

The clutch is built to "slip" when it should slip, and rough handling cannot put it out of order. Special plates and cooling fins beat the heavy hand that "rides" a clutch.

Just send for a bulletin giving a complete description and specifications.

FAIRBANKS, MORSE & CO., *Chicago*

Manufacturers of railway motor cars; hand cars; push cars; velocipedes; standpipes for water and oil; tank fixtures; stationary and marine oil engines; steam, power and centrifugal pumps; scales; motors and generators; complete coaling stations.

TIMKEN BEARING EQUIPPED

RA 21.65

First on the rails
— and still first

FAIRBANKS-MORSE

MOTOR CARS

This Derail is the Ultimate in Simplicity and Economy

Photograph showing an actual installation of the Q & C Self Adjusting Sliding type Derail.

THERE are many reasons why the Q & C Self Adjusting Sliding type Derail reaches new heights in simplicity and economy.

Simplicity: There is only one model and this covers all the rail sections. It is easily installed with standard track tools and there is no adzing or shimming the ties. The derail blocks and housings are interchangeable, and should one be broken it is only necessary to replace the broken part by another taken from the storehouse. The derail block can be put in without removing the housing.

Economy: Only one model is necessary in your storehouse to fit all rail sections. Base plates extend under the rail giving a firm installation, assuring a positive derailment and eliminating the necessity of rail braces and other extra material.

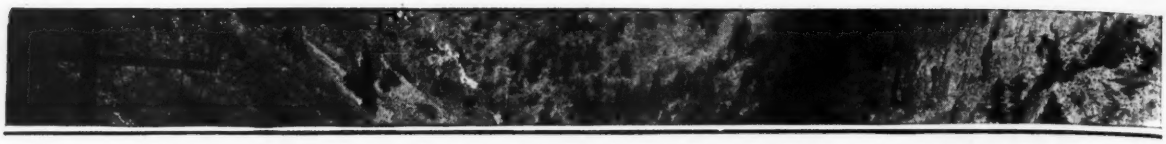
The Q & C Self Adjusting Sliding type Derail is designed for use with standard screw jaw and rod connections in all interlocking and operating stand installations. Standard track tools are used.

We will be glad to demonstrate to your satisfaction the simplicity and economy of the Q & C Self Adjusting Sliding type Derail.

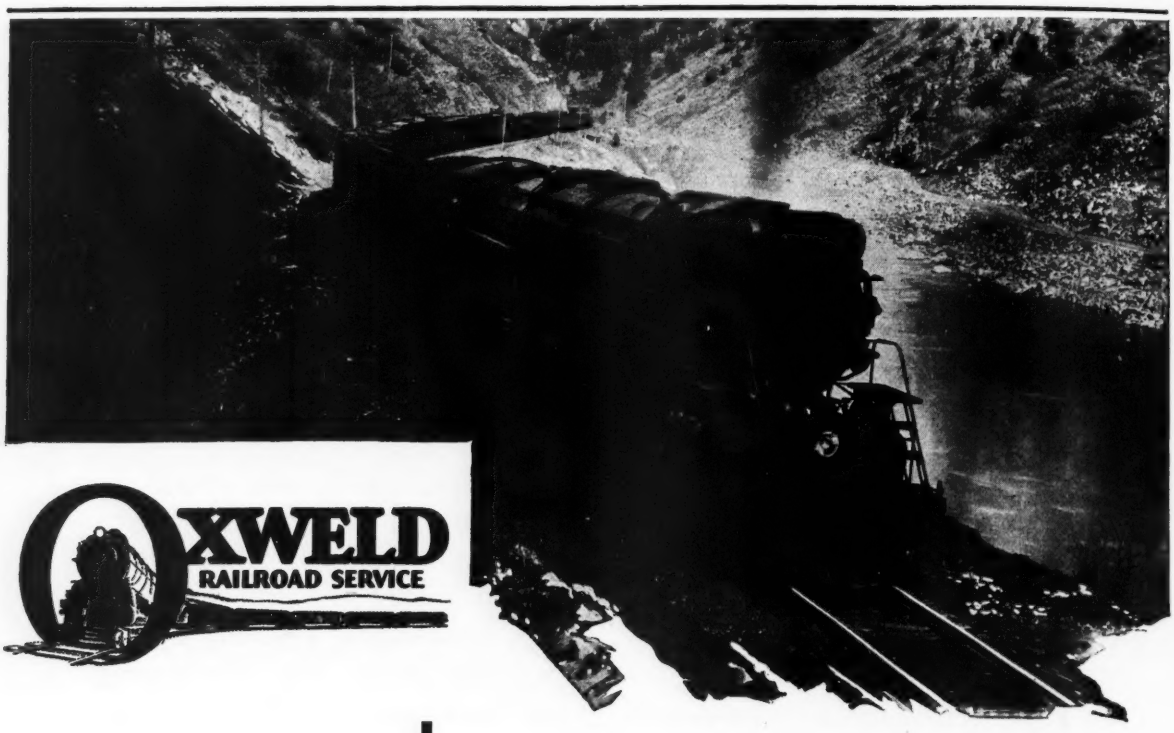
The Q & C Company, 90 West St., N. Y.

Manufacturers of Track, Car and Engine Devices

ST. LOUIS - - - - People's Gas Building
CHICAGO - - - Railway Exchange Building



LONGER–HEAVIER–FASTER TRAINS



IMPROVED condition of track, resulting from modern methods of track maintenance, is one of the prime factors enabling the safe operation of power units of sufficient capacity to handle the longer, heavier trains necessary to take care of increasing freight business. Faster movement of heavy trains materially increases the capacity of the railway plant and is an important contribution toward the betterment of railway earnings.

The Oxweld Railroad Service Company, by supplying the oxwelding needs of a majority of the Class 1 railroads of the country is helping in the constant improvement of maintenance methods.

THE OXWELD RAILROAD SERVICE CO.
Unit of Union Carbide and Carbon Corporation
UCC

NEW YORK CITY
Carbide and Carbon Bldg.

CHICAGO
Carbide and Carbon Bldg.

RE-GAUGING ELIMINATED in Relaying Rail

TRACK regauging, heretofore regarded as an unavoidable expense in relaying rail, is eliminated by adzing ties with the Nordberg Power Adzing Machine.

When ties are adzed by hand, it is impossible to obtain a uniform rail bearing on all ties; hence under traffic the rail tips slightly one way or the other to obtain a full bearing on the greatest number of ties, thus destroying the accuracy of the gauge. Frequently two regauging jobs are required, with resultant "spike killing" of ties.

But with the Nordberg Adzing Machine, **every tie** is adzed to exactly the same plane—the rail rests on every tie and does not tip under traffic. Regauging is no longer necessary.

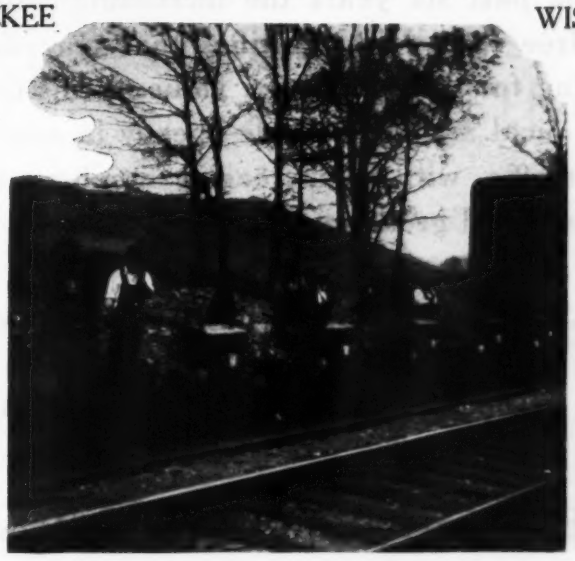
If a Nordberg Adzing Machine has not already taken the place of ten to twelve men in your relaying gangs, investigate its record of phenomenal speed and **perfect accuracy.**

Now is the time to plan cutting the costs on next year's track maintenance.

Full information and data on request

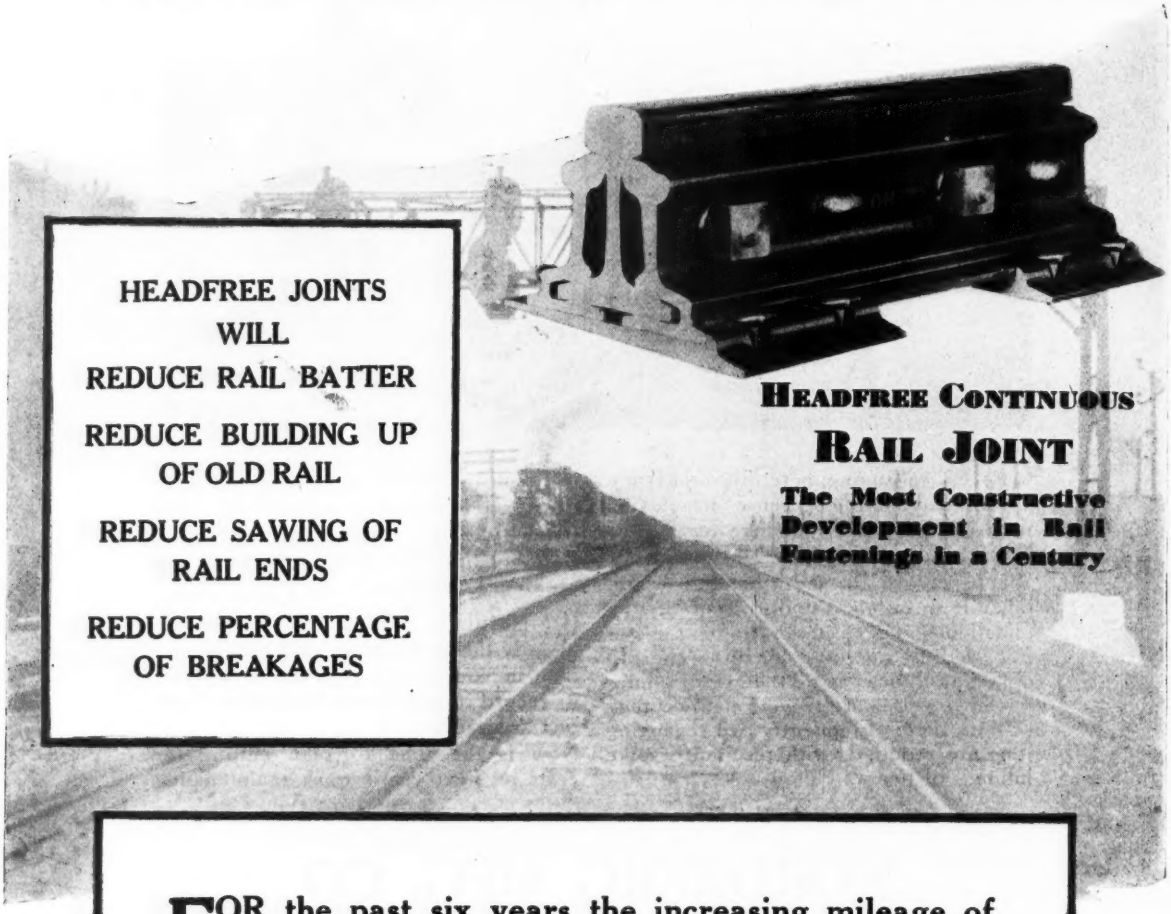
NORDBERG MFG. CO.

MILWAUKEE WISCONSIN



Five Nordberg Adzing Machines being used on a big-gang, rail-relaying job.

A MODERN DEVICE FOR MODERN TRAFFIC



FOR the past six years the increasing mileage of Headfree Rail Joints testifies that our customers are proving for themselves the value of this device as an economical and serviceable agency in coping with modern traffic, with its increasing number of trains, heavy loads and great speed.

KEEPING PACE WITH PROGRESS

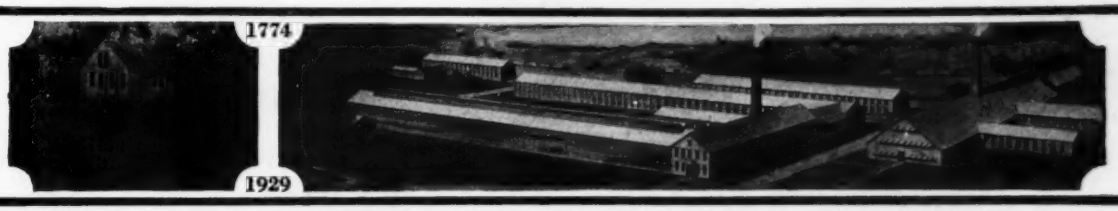
THE RAIL JOINT COMPANY

165 Broadway—New York

AMES—THE STANDARD FOR SHOVEL VALUE

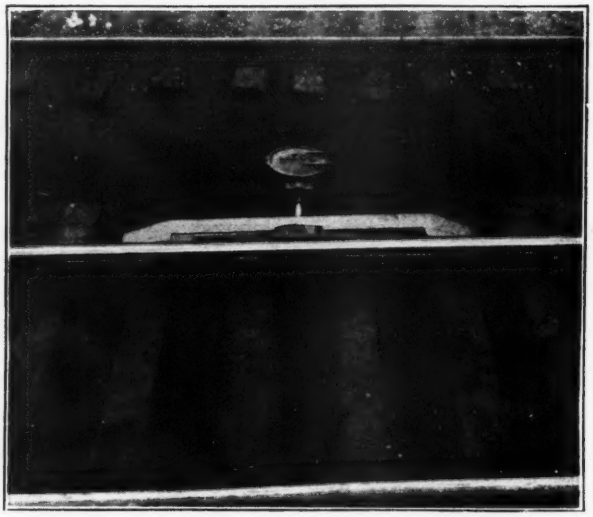
More AMES SHOVELS are used than any other kind

The complete "All Star" Ames Line covers every shovel need.
It will pay you to "Look for the Stars" on every shovel you buy.



AMES SHOVEL AND TOOL COMPANY
NORTH EASTON ◂▸ MASSACHUSETTS
ST. LOUIS, MISSOURI . . . ANDERSON, INDIANA

3474

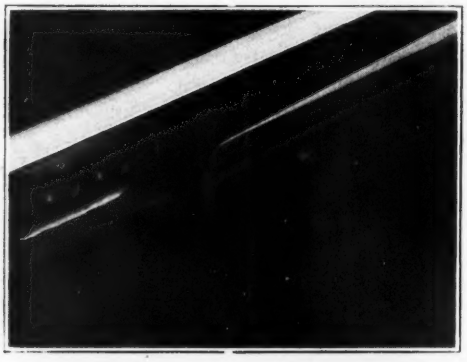


THE MECO

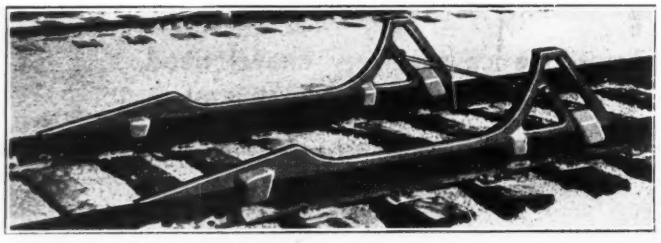
Rail and Flange Lubricator

Operates as well in Winter as in Summer

***Jackson* Power Track Ballaster**



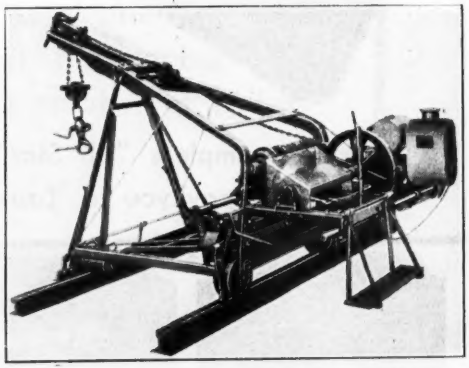
***Mack* Reversible Switch Point Protector—a life saver for the Switch Point in Winter**



Breyley

***Friction* Car Stops—**

Easily Installed in the dead of Winter



Power-operated Three-Man Rail Layer

MAINTENANCE EQUIPMENT COMPANY

Railway Exchange Bldg. Chicago, Ill.

New York Cleveland San Francisco St. Louis

A 4-Yd. Dump Car in 2 Minutes the Average of this P&H

P & H Model 700 Shovel Loading Railroad Dump Cars on Top of a 14 ft. Cut Near Tyler, Texas.

THE speedy, steady performance of P & H Gasoline and Diesel-Powered Excavators insures big production under all conditions.

P & H has the fast line and swing speeds—so essential for loading these railroad dump cars. P & H Positive, Patented Chain Crowd makes it possible for the operator to maintain the specified accurate grade, and the positive pushing action on the dipper sticks insures maximum lift with minimum boom length.

Accurate control of the dipper, high lift, speed and plenty of power are all extremely important requirements for economical grading.

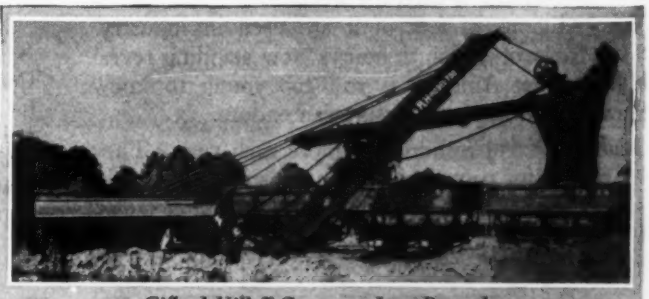
The P & H 1 and 1¼ cu. yd. Shovels, grading for the Cotton Belt Railroad near Tyler, Texas, are demonstrating these necessary features to the entire satisfaction of the contractors, Gifford Hill & Company, Inc., Dallas, Texas.

One of the 1¼ cu. yd. machines, working day and night, is loading dump cars at the top of a 14 ft. cut at the rate of a car every two minutes.

Economical, satisfactory performance accounts for the fact that Gifford Hill just added the sixth P & H to their fleet.

Let us send you catalogs descriptive of P & H Gasoline and Diesel-Powered Excavators—½ to 3½ cu. yds. capacity.

HARNISCHFEGER CORPORATION
Established in 1884
3820 National Avenue, Milwaukee, Wisconsin
Offices and Agents in All Principal Cities
WAREHOUSES AND SERVICE STATIONS
Philadelphia, Memphis, Jacksonville, San Francisco, Los Angeles, Seattle, Dallas



Gifford Hill & Company, Inc., Recently Added the Sixth P & H to Their Fleet.

P&H DIESEL EXCAVATORS

110 Years Old

—they still smile at moisture and the sun

THESE three old-timers set out in service shortly after Lewis and Clark set out for the unexplored West. And now, after a hardy career on a Southern plantation, they are still on active duty—with never a thought of retirement.

Their striking testimony is only one of the thousand proofs of the durability of Tidewater Red Cypress. For this lumber is used the world over in shipbuilding. Millions of feet of it are used in industry. Hundreds of Colonial houses now standing reveal the fact that America is still too young to know how long a cypress structure can endure.

Railroads favor it more and more each year. They employ it for passenger station construction, freight sheds, warehouses, platforms, conduits, water tanks, cars, fencing, and every other place where upkeep must be cut down.

For economy in your business, use this Wood Eternal. Its first cost is your last cost. It knows no replacement, or repair bills.

When you order this wood, be sure to specify Tidewater Red Cypress, for only "coastal type" red cypress has these qualities of durability.

"Money Saved for Builders"—sent free

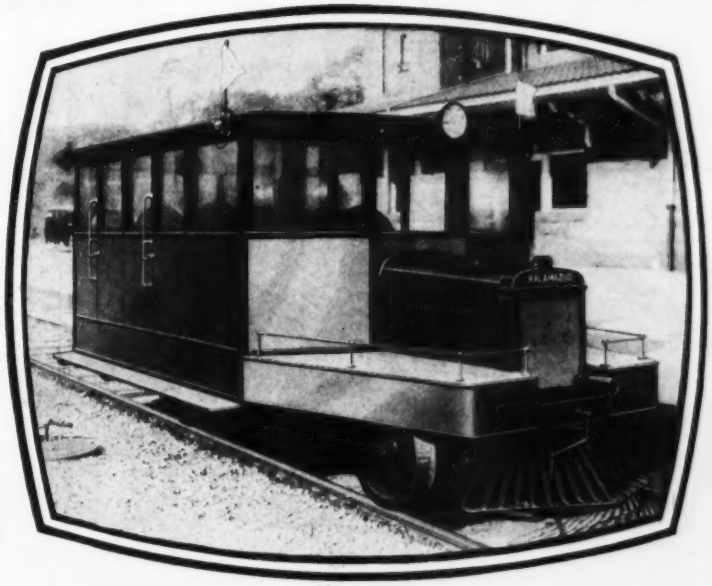
Complete data on Tidewater Red Cypress, and suggestions for cutting down the operating expenses of your business and your home, await you in "Money Saved for Builders." This interesting booklet will be sent free on your request. Southern Cypress Manufacturers Association, Dept. RE-6, Barnett Building, Jacksonville, Florida.

Specify TIDEWATER RED CYPRESS

THE WOOD ETERNAL

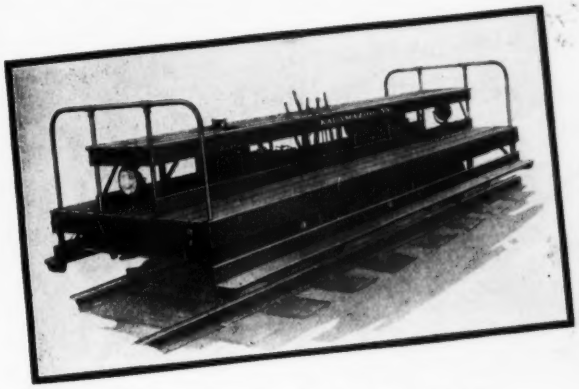
SERVICE of an Ever-Widening Scope

KALAMAZOO MEANS SERVICE TO YOU



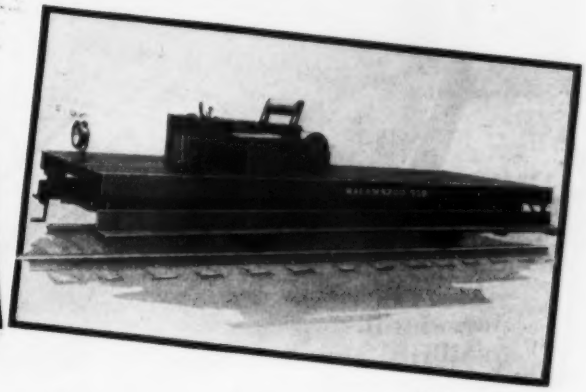
The Luxurious Kalamazoo 55-12

The 12 passenger Officials' Inspection Car. Deep bus type seats. Inspection parties or passengers ride mile after mile in this car without fatigue. It's built for comfort, safety and speed.



Kalamazoo Heavy Work Car No. 55

Seats 50 men and has ample power to haul several loaded trailers



Kalamazoo Heavy Work Car No. 55-B

This is the No. 55 car, without superstructure showing how a large flat deck space may be provided for loading materials. This car is ideal for use on logging railroads or for carrying large construction gangs.

Established in 1883, we are still pioneers in the development of labor, money, and time-saving motor cars and other track equipment that meet and anticipate the constantly growing needs of American and foreign railroads.

The series of "Kalamazoo 55 Motor Cars" is so designed that it is adaptable to many kinds of service. Special types of bodies may be applied to the standard 55 chassis in order to satisfy specific requirements.

Complete catalog information promptly sent on request

ESTABLISHED 1883

KALAMAZOO RAILWAY SUPPLY CO.

MANUFACTURERS—Established 1883

KALAMAZOO, MICHIGAN, U. S. A.

KREOLITE

SOLID UPLAND MOUNTAIN OAK R. R. CROSS AND SWITCH TIES

The favorable location of our several Plants enables us to purchase solid Upland Mountain Oak to advantage.

The life of treated timber depends upon the character of the preservative used. **We distill our own Creosote Oil.** By so doing it is possible for us to insure to the purchaser a uniform pure product of any grade desired.

Enormous stocks of Cross Ties, Switch Ties, Structural Timbers and Piling, in all sizes, in Solid Oak or Pine, properly sticked and air seasoned before treatment, available for prompt shipment from Toledo, Ohio, or our Midland Creosoting Company plant, Granite City, Ill. (East St. Louis).

THE JENNISON-WRIGHT COMPANY, TOLEDO, OHIO

Branches in All Large Cities

R.R. TIES

Cold Weather *cannot stop a* SYNTRON

--because Electricity cannot freeze!

BESIDES permitting tie-tamping in cold weather without danger of freezing, the SYNTRON Portable Electric Outfit enables you to operate a large number of electrical labor-saving tools for nut-tightening, drilling, sawing, spike-driving, hammering, and other maintenance operations.

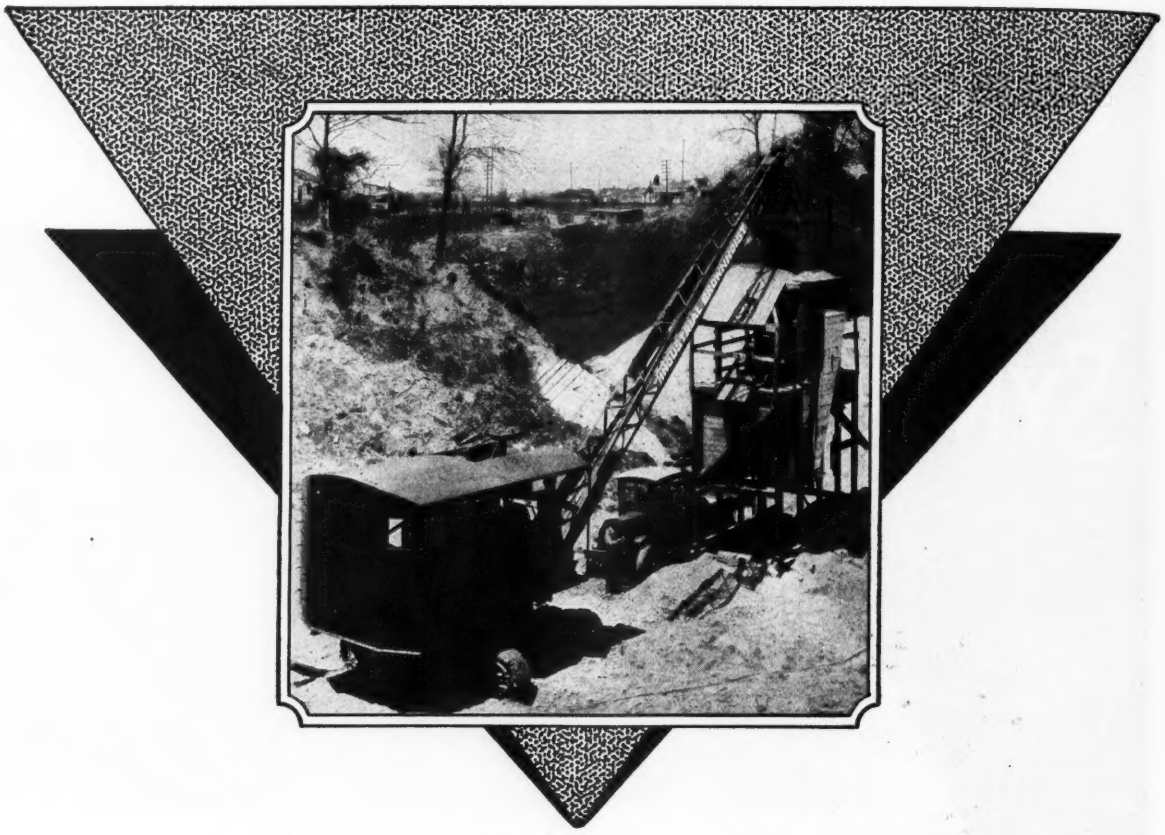
The SYNTRON Power Unit is compact and sturdy, only 20 inches wide, can be easily lifted by four or five men, rides on the rail, rests on the track shoulder, and operates 2, 4 or 6 electrical tampers in addition to a number of electrical tools.

Investigate the SYNTRON . . . Write for descriptive literature. No obligation.

SYNTRON COMPANY, 400 Lexington Ave., Pittsburgh, Pa.

SYNTRON

Electric Tie-Tamping Outfits



Again – Lower Cost – Less Upkeep – Faster Work

"We are well pleased with our Industrial Brownhoist crawler shovel crane in every respect. It has been very satisfactory," writes the S. F. Clough Sand and Stone Co., of Syracuse, New York. "We have used it constantly for stripping over-burden and digging back-run sand. We find it very fast compared with the other three cranes that we use in the same line of work. The crane has required very few repairs."

This is just another example of an Industrial Brownhoist saving time and money because of our ability to furnish a quality product of just the right size and type to do the work. Among these products are convertible shovel cranes, locomotive cranes, ditchers and clamshell buckets.

Our nearby representative will gladly suggest the right equipment for your own material handling work.

Industrial Brownhoist Corporation, General Offices, Cleveland, Ohio

District Offices: New York, Philadelphia, Pittsburgh, Detroit, Chicago, New Orleans, San Francisco.

Plants: Brownhoist Division, Cleveland; Industrial Division, Bay City, Michigan; Elyria Foundry Division, Elyria, Ohio.

INDUSTRIAL BROWNHOIST

Safe . . . when it's Red-Leaded

SAFE from rust . . . from destruction! And steelwork protected by pure red-lead paint requires a minimum of maintenance work. This paint provides sure protection against corrosion . . . safeguards the strength and life of steel structures . . . lasts for a remarkably long time.

Engineers and others who have studied paint for metal know that three coats of pure red-lead give lasting protection . . . provide a film unexcelled in rust-proofing qualities.

Fine, uniform, highly oxidized, there is no better red-lead obtainable than Dutch Boy red-lead. It comes in two forms . . . paste and liquid. The liquid (ready for the brush) is supplied in six colors—natural orange-red, light and dark brown, light and dark green, and black. The paste comes in natural orange-red and can be shaded to dark colors.

NATIONAL LEAD COMPANY

New York, 111 Broadway • Buffalo, 116 Oak Street
Chicago, 900 West 18th Street • Cincinnati, 659 Freeman Ave. • Cleveland, 820 West Superior Ave. • St. Louis, 722 Chestnut St. • San Francisco, 235 Montgomery St.
Boston, National-Boston Lead Co., 800 Albany St. • Pittsburgh, National Lead & Oil Co. of Pa., 316 Fourth Ave.
Philadelphia, John T. Lewis & Bros. Co., Widener Bldg.

DUTCH BOY RED-LEAD

Model 20

BURRO CRANE

Model 30

Draw Bar Pull

Cuts

Work Train Time

Model 20 Burro Crane loading changed out-rail. The Burro, due to its Draw-Bar Pull, has eliminated the use of a work train.

Burro Features

Utility
Long Reach
Low Overall Height
Travel Speeds
1½ to 20 miles per hour
Draw-Bar Pull
6000 to 7000 lbs.

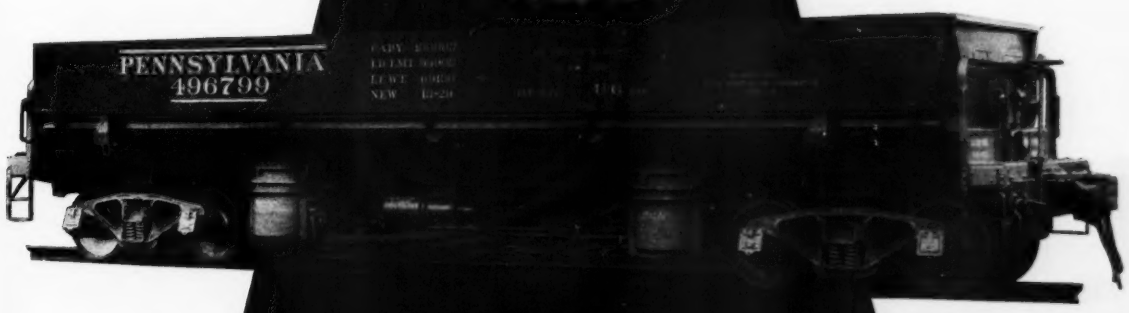
Rated Capacities
Model 20 . . . 11,000 lbs.
Model 30 . . . 14,700 lbs.

In maintenance and construction work, a Burro Crane can very frequently be used for hauling and switching its own cars in addition to handling heavy loads. Such crane operation makes possible tremendous savings by eliminating the costly services of a work train as well as by handling material most economically.

Draw-Bar Pull is only one of the many features which enable the Burro to give the utmost in crane service. Write for Bulletin F-50 which shows the importance of Burro features in actual crane operation.

Cullen-Friestedt Company, 1300 South Kilbourn Avenue, Chicago

The KOPPEL RTD



The ideal car for railroad maintenance

Skillfully designed—reliable and positive in operation the strong, sturdy RTD Dump Car is helping railroads and railroad contractors cut their costs, and speed up maintenance and improvement work.

Get all the facts about this Koppel RTD—let us tell you what it is doing in service, and how it is giving maximum economy—together with maximum output for railroads, contractors and industry throughout the United States.

Complete literature upon request.

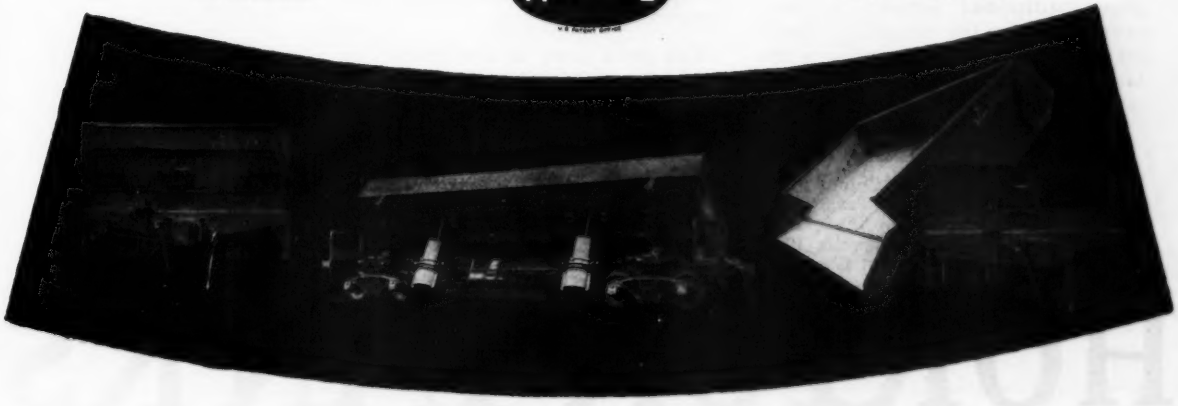
Koppel Industrial Car & Equipment Company

Koppel, Penna.

NEW YORK
PITTSBURGH

KOPPEL

CHICAGO
SAN FRANCISCO



200,000 gallon Horton tank 21 feet to bottom at the Chicago Western Indiana railroad shops at Chicago, Illinois.

STEEL Tanks for Busy Water Stations

The railroad water station which requires a reserve of several hundred thousand gallons usually is a busy one. Sometimes several locomotives draw from it at the same time through different cranes.

Horton steel tanks are the kind to install at busy stations. They give continuous service without even time out for cleaning. Sediment from the water settles in the large riser and collects in a small area at its bottom. It is cleared from the tank by simply opening the washout valve for a short time at periodic intervals.

The inlet and outlet pipe is extended several feet above the bottom of the riser where sediment collects. The sediment cannot be stirred up into the water again by filling or drawn out into locomotive tenders.

Ask for a copy of the booklet at the right and quotations on tanks you contemplate installing.

B-117

CHICAGO BRIDGE & IRON WORKS

Chicago	2452 Old Colony Bldg.	Detroit	1519 Lafayette Bldg.
New York	3156 Hudson Term. Bldg.	Philadelphia	1609 Jefferson Bldg.
Cleveland	2202 Union Trust Bldg.	Atlanta	1036 Healey Bldg.
Dallas	3309 Magnolia Bldg.	San Francisco	1007 Rialto Bldg.
Boston	1522 Consolidated Gas Bldg.	Havana	Apartado 2507

HORTON TANKS

Use the Improved Jordan Railway Track Oiler

for Economical and Proper Application of Oil to Railway Track Structure

JORDAN RAILWAY TRACK OILER

Manufactured By

O. F. JORDAN CO.

EAST CHICAGO INDIANA

AUTOMATICALLY OILS RAIL JOINTS AT A SPEED OF 8 MILES PER HOUR. JOINTS, BOLTS AND NUTS ARE THOROUGHLY COATED.

APPLIES PROTECTIVE COATING OF OIL TO ENTIRE RAIL AND FASTENINGS AT A SPEED OF 15 MILES AN HOUR USING 1 GALLON OF OIL A MILE FOR EACH POUND OF RAIL PER YARD.

—Self-Propelled

—Ruggedly Constructed

—Heavy Steel Wheels

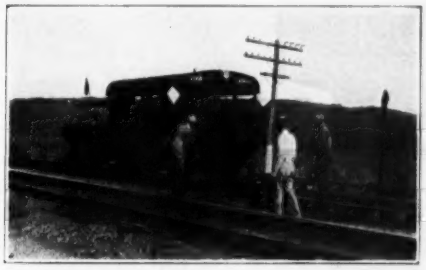
—Roller Bearings

—Heavy Duty Mechanism

—Maximum Speed 25 M. P. H.

—Straight and Automatic Air Brakes

—Economically Performs Every Railway Track Oiling Function



JORDAN RAILWAY TRACK OILERS ARE EQUIPPED WITH HAND-OPERATED SPRAYS FOR OILING SWITCHES, FROGS, INTERLOCKERS, ETC.

APPLIES DUST-LAYING, WEED-KILLING COAT OF OIL OR OTHER COMPOUND TO ROAD-BED AT SPEED OF 6 to 8 M.P.H.

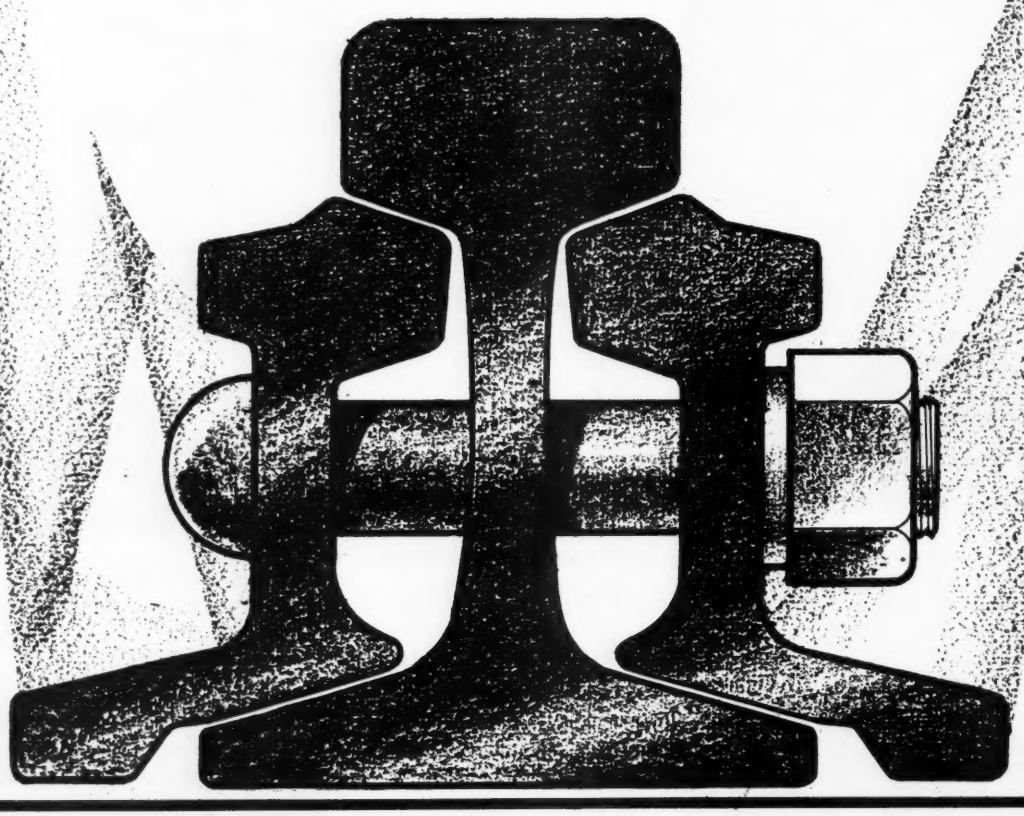
DRAWBAR PULL—VERY HIGH—ENABLES PULLING STANDARD TANK CARS FOR HEAVY OIL APPLICATIONS.

ELIMINATES USE OF LOCOMOTIVES ENTIRELY. PERFORMS OWN SWITCHING OPERATIONS WHEN NECESSARY.

Now Successfully Operating on Many Leading Trunk Line Railways

STEEL SERVICE

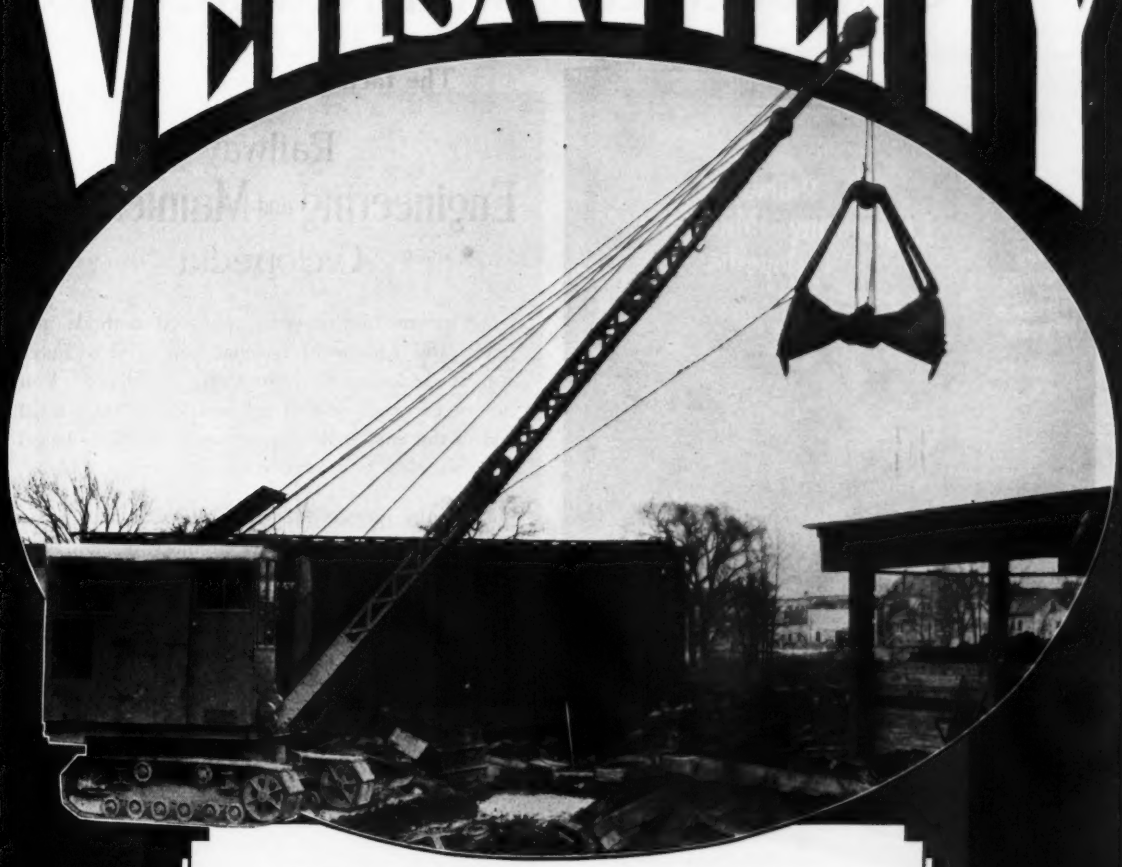
CONTROL of manufacture from the mining of the ore until the finished product is ready for shipment, combined with extensive and modern manufacturing facilities, enable us to promptly and efficiently supply your steel requirements. Carnegie products of special interest to railroads include Standard Rails and Heat Treated Splice Bars, Structural Shapes, Bar Mill Products, Wrought Steel Wheels, Forged Steel Axles and Steel Sheet Piling. Let us quote on your next requirements.



CARNEGIE
RAILS *and* SPLICES

Products of CARNEGIE STEEL COMPANY, Pittsburgh, Pa.—*Subsidiary of United States Steel Corporation*

VERSATILITY



HUNDREDS of construction and maintenance operations, now being performed by hand or by highly specialized machines, can be handled more advantageously and economically with the Buckeye Utility Crane. As Clamshell, Crane, Dragline, Orange-peel and Backfiller, it has an unusually wide service range.

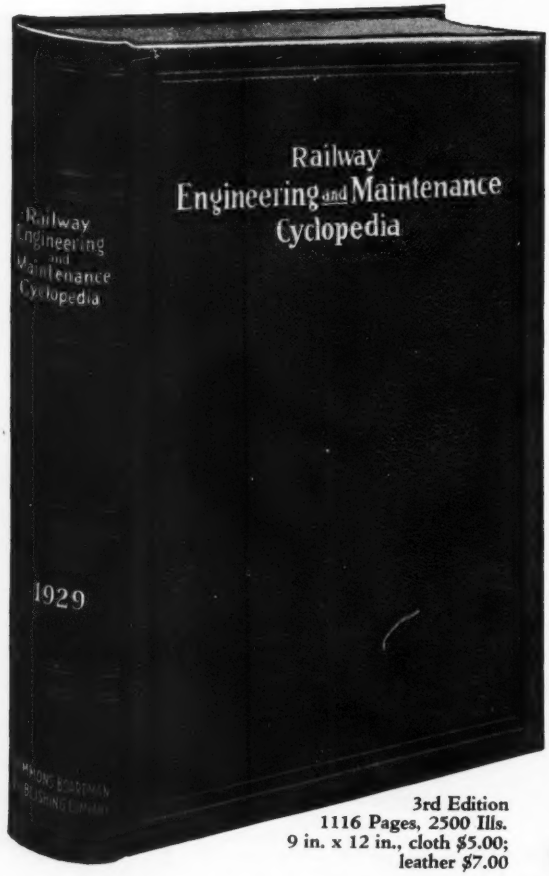
Every day this Buckeye will pay its way on some job or other—laying, loading or unloading rail; handling frogs, switches and culvert pipe; transferring coal, cinders and engine sand; shifting miscellaneous construction units and materials; and in handling a large variety of small excavation work. *Flanged wheels* fit it for operation from track or from rails laid on flat car. *Alligator (crawler) traction* is for duty independent of rails. Write for complete specifications. The price, too, will interest you.

THE BUCKEYE TRACTION DITCHER CO., *Findlay, O.*

Buckeye

THERE'S A BUCKEYE SALES AND SERVICE OFFICE NEAR YOU

When a New Engineering Problem Arises Can You Meet It with New Methods?



3rd Edition
1116 Pages, 2500 Ills.
9 in. x 12 in., cloth $5.00;
leather $7.00

The facts you need are in the

Railway Engineering and Maintenance -1929- Cyclopedia EDITION

Exact information on latest approved methods, materials and equipment is what you need to make correct decisions on engineering problems. You cannot carry all of this information in your head and in the final analysis your opinion will be based upon the data you refer to for authority.

Here is the only reference volume containing the latest information on railway engineering, signaling, and maintenance problems. The cooperation of the American Railway Engineering Association and the Signal Section of the A. R. A. guarantees the authenticity of its information.

With a copy of this Cyclopedia on your reference shelf you can get the correct information you want quickly. Newest equipment, adopted specifications and standard practice are instantly found with the aid of the index.

Contains Seven Big Sections

BUILDING SECTION, describing in detail all of the important buildings coming under the supervision of the building department.

WATER SERVICE, describing the sources of water supply and methods of treatment, distribution and storage.

SIGNAL SECTION, containing the only up-to-date, authoritative description of signaling devices and practices in book form.

GENERAL SECTION, covering wood preservation, metals, paint, power units, wire rope and chain, etc.

DEFINITION SECTION, based upon the official terminology of the A. R. E. A. the Signal Section, A. R. A. the A. W. P. A., etc.

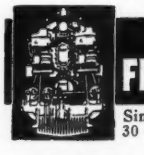
TRACK SECTION, covering every phase of track construction and maintenance.

BRIDGE SECTION, covering the construction, equipment and maintenance of all kinds, of railway bridges.

Order Your Copy Today

Fill out and mail the Free Examination Coupon and we will send you a copy of the **Cyclopedia** for ten days. Give it a fair working tryout on the job. Let it help you on important problems. See how much quicker you can check up on the information you need to make correct decisions.

If you then wish to keep it remit the very moderate list price. Otherwise simply send the book back.



SIMMONS-BOARDMAN
FREE EXAMINATION COUPON

Simmons-Boardman Publishing Company
30 Church Street, New York

Please send me postpaid a copy of the { $5.00 cloth / $7.00 leather } 1929 Edition of the Railway Engineering and Maintenance Cyclopedia for ten days' free examination. After ten days I will remit the total price, or if I do not desire to keep the book I will return it to you in good condition.

NAME.....

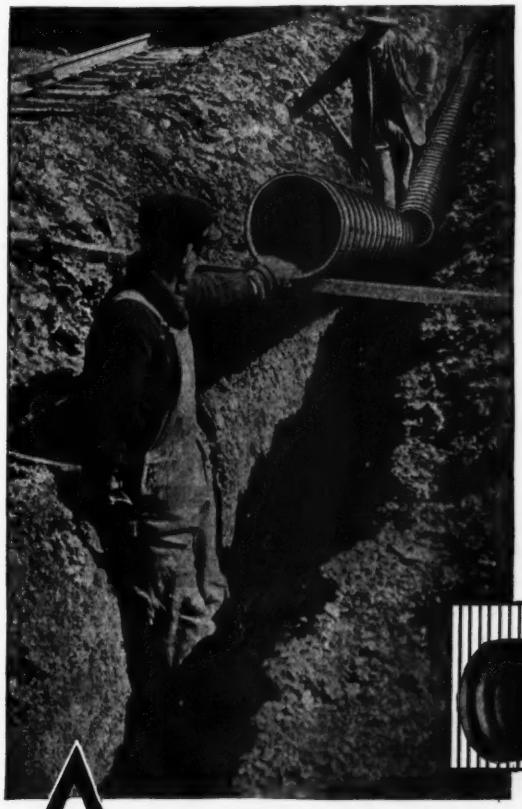
ADDRESS.....

CITY..... STATE.....

POSITION..... COMPANY.....

(Sent on approval to retail purchasers in U. S. and Canada only.) RE&M-12-29

Free the road-bed of surface waters



ANY PLACE in the road-bed where water ponds is a potential danger spot and a source of maintenance.

Adequate drainage is a first step towards reduced maintenance costs. Consider now where drains can be used to advantage. Making liberal use of them is good economy.

For drains of unusual efficiency and long life the choice of many railroads is Toncan Iron.

Toncan Iron drains have an added resistance to corrosion and erosion gained through the protective presence of copper and molybdenum. These elements give the naturally resistant iron still further protection against weathering and corrosion.

TONCAN CULVERT MANUFACTURERS' ASSOCIATION
MASSILLON, OHIO

TONCAN COPPER MO-LYB-DEN-UM IRON

No. 12 of a series

PUBLISHER OF
RAILWAY AGE
RAILWAY MECHANICAL ENGINEER
RAILWAY ENGINEERING AND MAINTENANCE
RAILWAY ELECTRICAL ENGINEER
RAILWAY SIGNALING
MARINE ENGINEERING AND SHIPPING AGE
THE BOILER MAKER

Railway Engineering and Maintenance

SIMMONS-BOARDMAN PUBLISHING COMPANY

"THE HOUSE OF TRANSPORTATION"

PUBLISHER OF
LOCOMOTIVE CYCLOPEDIA
CAR BUILDERS' CYCLOPEDIA
RAILWAY ENGINEERING AND MAINTENANCE CYCLOPEDIA
BOOKS ON TRANSPORTATION SUBJECTS

NEW YORK 30 CHURCH STREET | CHICAGO 105 WEST ADAMS ST. | CLEVELAND 50 PUBLIC SQUARE | WASHINGTON 17TH AND H STS. N.W. | SAN FRANCISCO 215 MARKET STREET

ADDRESS REPLY TO
105 WEST ADAMS ST.
CHICAGO, ILL.

November 28, 1929

Subject: A SINGLE POINT

Dear Reader:
Everywhere

When the football teams of the universities of Southern California and Notre Dame met at Soldier Field, Chicago, a couple of weeks ago they played before the largest number of people that had ever congregated for an athletic contest. The two teams were evenly matched and each made two touchdowns; yet when the crucial moment came, the more than 120,000 spectators saw victory go to Notre Dame by reason of its ability to kick one more goal after touchdown than its adversary. The game was won by a single point, but it was won just as decisively as if it had been earned by a wide margin.

Because of my enthusiasm for football the thought frequently comes to me, in noting the changes and promotions that are constantly occurring in railway service that, like a gridiron contest, promotions are frequently made on the basis of a single point. Not infrequently a supervisory officer, facing the problem of filling a position, is confronted with two candidates who compare equally in experience and in industry; yet one seems to have a better "knack" of knowing what to do and how to do it than the other and he receives the appointment.

In a conversation with such a man recently I endeavored to ascertain the reason for this "knack" and I found that he attributes it to a reservoir of practical ideas that he has stored up in his mind by the consistent reading of Railway Engineering and Maintenance over a period of years. In this way he has accumulated from the experience of others a vast store of information that comes to his aid automatically when a problem arises. This is the return he receives from his magazine. It is a return which no crash on Wall Street can wipe out. It brings him dividends every pay day.

Yours truly,

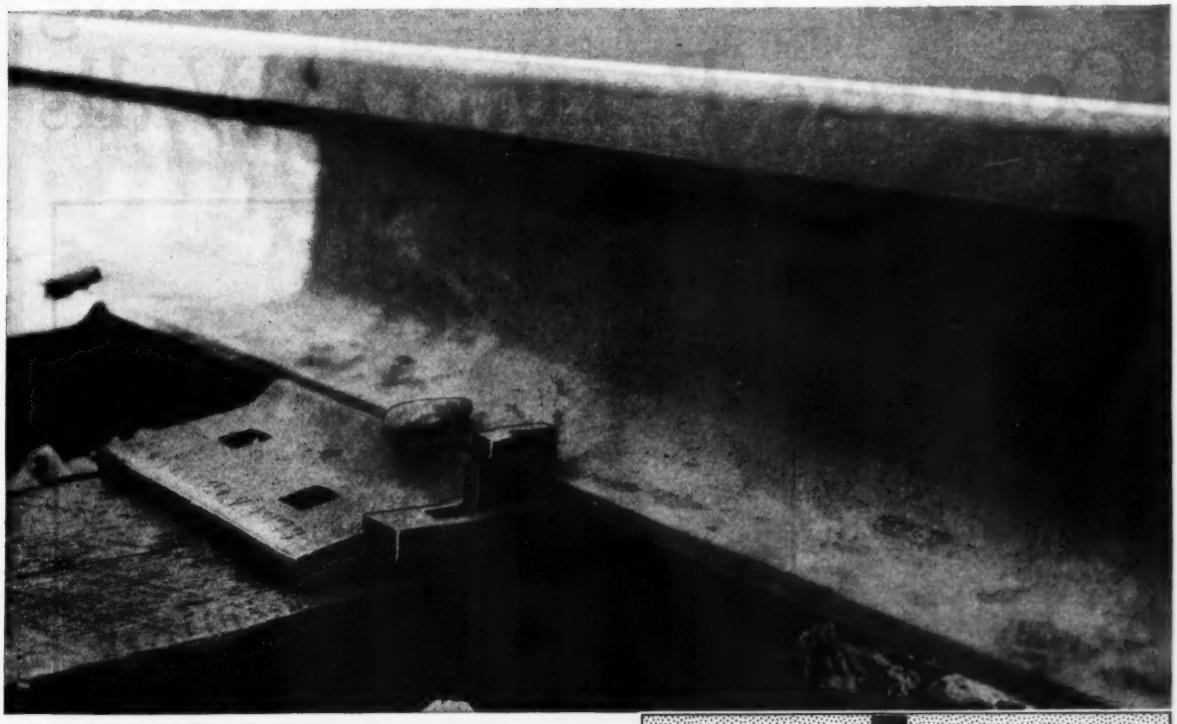
ETH*MM

Elmer T. Howson

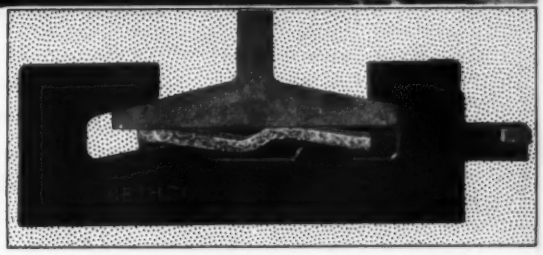
Editor.

MEMBERS: AUDIT BUREAU OF CIRCULATIONS AND ASSOCIATED BUSINESS PAPERS, INC.

BETHCO RAIL ANCHOR



Holds



new, worn or corroded rail

Heavy, high-speed trains place a severe burden on rail fastenings and cause rail creep.

The Bethco Rail Anchor prevents creeping. It holds the rail tightly, whether the rail base is new and full-size, or reduced in section by wear or corrosion. The anchor consists of a self-locking key and yoke, so assembled that it is shipped, handled, and installed as one piece. It wedges at right angles to the rail base and does not loosen under the contraction and expansion of the rail. The width of the anchor gives exceptional bearing surface and saves the tie.

Write for descriptive literature.

BETHLEHEM STEEL COMPANY

General Offices: Bethlehem, Pa.

District Offices: New York, Boston, Philadelphia, Baltimore, Washington, Atlanta, Pittsburgh, Buffalo, Cleveland, Detroit, Cincinnati, Chicago, St. Louis, San Francisco, Los Angeles, Seattle, Portland, and Honolulu.

Bethlehem Steel Export Corporation, New York City, Sole Exporter of our Commercial Products

BETHLEHEM

Winter—no bar to erecting Concrete Retaining Walls

Note the Y-shaped headers which interlock with the stretchers, holding the backfill without the use of a third member in the bank. This results in a cellular wall of great strength and with no plane of cleavage in the bank.

The bugaboo of building forms and pouring concrete walls in cold weather is a thing of the past. Modern practice utilizes *precast* units—factory made and cured, brought to the site and unloaded direct from cars to wall—*in any weather!*

Federal 2-piece cribbing is particularly advantageous for winter installation because fewer units mean less handling, and speedier erection.

What other retaining wall today so strong and stable, so permanent and economical—with closed-face beauty to match Federal construction? *And there is no maintenance whatever.*

Many leading roads have demonstrated Federal merit—Pennsylvania, New York Central, Grand Trunk, B. & O., Northwestern, and others. Special cribbing booklet illustrating and describing this advanced design, sent on request.

FEDERAL CEMENT TILE COMPANY, 608 South Dearborn Street, Chicago, Illinois

Concrete Products *for Over 25 Years*

FEDERAL 2 piece Concrete CRIBBING

ELMER T. HOWSON, *Editor*
WALTER S. LACHER, *Managing Editor*
NEAL D. HOWARD, *Eastern Editor*
GEORGE E. BOYD, *Associate Editor*

Railway Engineering and Maintenance

F. C. KOCH, *Business Manager*
H. F. LANE, *Washington Editor*
M. H. DICK, *Associate Editor*

Name Registered U. S. Patent Office
Formerly the Railway Maintenance Engineer
Published on the last Thursday preceding the month of issue by the
Simmons-Boardman Publishing Company
105 West Adams Street, Chicago

CONTENTS FOR DECEMBER, 1929

Editorials 527
Another active year in sight—Organizing to fight snow—What of the concrete tank?

A Billion Crossties 530
R. S. BELCHER *tells what must be done to get a full return on what they cost*

Capital Outlays Larger in 1929 533
Expenditures for additions and betterments exceed those for both 1927 and 1928

Floating Concrete Pipes into Place 534
Collapsible bulkheads provide means of placing large drainage lines under water

Speed Up Special Track Work 538
W. L. CHOATE *describes ingenious methods used in replacing crossings and slip switches*

Concrete Tanks Give Good Service 541
R. A. TANNER *explains improvements made following experience under severe conditions*

Treated Wood in Sash Construction 544
Use of creosoted lumber in roundhouse windows proves economical

Making Waste Lumber Pay Dividends 545
Burlington uses salvaged material in doors, fences and ready-made buildings

Fewer Ties Treated in 1928 547
Statistics show reduction in volume of timber preserved but increase in use of chemicals

Pennsylvania Holds Annual Inspections 548
Announces award of prizes to supervisors of track in the three regions

No Let-Up in Expenditures 549
Railways come to the aid of President Hoover in restoring confidence

What's the Answer? 551

New and Improved Devices 558

What Our Readers Think 560

With the Associations 561

Railway News Briefly Told 562

SIMMONS-BOARDMAN PUBLISHING COMPANY, Edward A. Simmons, *President;* L. B. Sherman, *Vice-President;* Henry Lee, *Vice-President;* Samuel O. Dunn, *Vice-President;* C. R. Mills, *Vice-President;* F. H. Thompson, *Vice-President;* Roy V. Wright, *Secretary;* and John T. DeMott, *Treasurer.*

Subscription price in the United States, Canada and Mexico, $2.00 per year; foreign countries $3.00. Single copies, 35 cents.

New York: 30 Church Street
Chicago: 105 W. Adams Street
Cleveland: Terminal Tower
Washington, D. C.: 17 and H Streets N. W.
San Francisco: 215 Market Street

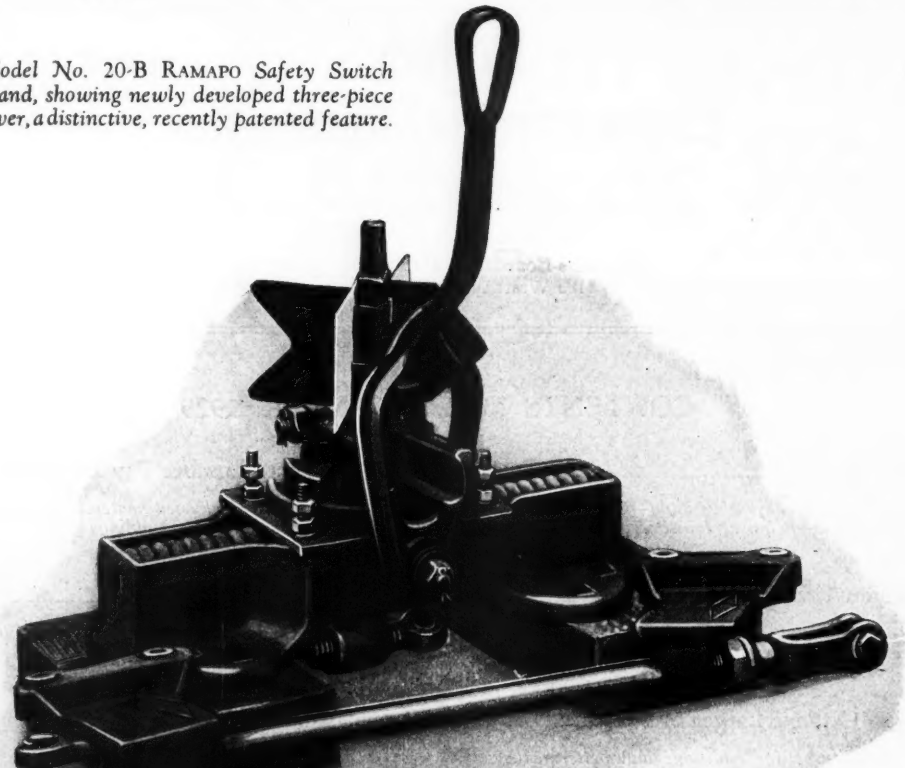
Publishers also of
Railway Age — Railway Mechanical Engineer
Railway Signaling — Airway Age
Railway Electrical Engineer — The Boilermaker
Marine Engineering and Shipping Age
Railway Engineering and Maintenance Cyclopedia
Car Builder's Cyclopedia — Locomotive Cyclopedia
American Builder — House Furnishing Review

Member of the Associated Business Papers (A. B. P.) and of the Audit Bureau of Circulations (A. B. C.).

Request for change of address should reach us two weeks before the date of the issue with which it is to go into effect. In sending us change of address please be sure to send us your old address as well as the new one.

Entered at the postoffice at Chicago, Ill., as mail matter of the second class.

Model No. 20-B RAMAPO *Safety Switch Stand, showing newly developed three-piece cover, a distinctive, recently patented feature.*



Further Economies in Trackwork Maintenance

Cars that trail through closed switches with rigid switch stand, invariably damage the switch points or break the switch stands. Derailments frequently add to the resulting troubles. Delays and expense accumulate.

All this is unnecessary.

With the Ramapo Safety switch stand in use, closed switch points, when wrongly trailed, move under the pressure of the wheel flanges, the switch is automatically reversed, the target follows the points and indicates their exact position. This automatic safety feature prevents damage to switch and switch stand, prevents derailments, speeds up the handling of cars, reduces track maintenance. In every other respect the operation of the switch stand is standard.

Widely used by leading railroads, these safety switch stands are improving the operating records of classification yards wherever they are installed. The new, three-piece cover shown is making inspection and lubrication a very simple, routine task.

RAMAPO AJAX CORPORATION

General Offices—230 PARK AVENUE, NEW YORK

RACOR PACIFIC FROG & SWITCH CO. Los Angeles—Seattle

SALES OFFICES AT WORKS, AND
McCORMICK BUILDING, CHICAGO
METROPOLITAN BANK BLDG, WASHINGTON
BUILDERS EXCHANGE BLDG, ST. PAUL

CANADIAN RAMAPO IRON WORKS, LTD. Niagara Falls, Ontario

Nine Racor Works
Hillburn, New York. Niagara Falls, N.Y. Chicago, Illinois, East St. Louis, Ill.
Superior, Wis. Pueblo, Col Los Angeles, Cal. Seattle, Wash. Niagara Falls, Ont.

Behind Racor Service stand nine plants specializing in the manufacture and distribution of railroad track turnout and crossing equipment. Manganese Work for heavy traffic.

Railway Engineering and Maintenance

Volume 25 December, 1929 No. 12

Uniformity in Titles

THERE IS a note in the personal news columns of this issue that is of interest beyond the limits of the road directly concerned. It refers to the action of the Illinois Central in changing the title of its roadmasters to that of division engineer. For years, this road has been one of a steadily declining number that persisted in the use of the term roadmaster to designate the chief maintenance of way officer of a division, to whom bridge and building, signaling and water service supervisors as well as track supervisors reported, this title being adhered to on the ground that some of the men holding these positions did not possess engineering degrees from universities.

On most roads the term roadmaster has long been used to designate the officer in charge of the maintenance of track on an operating division or more frequently on a subdivision. As long as other roads persist in using this term to denote one with other duties and responsibilities confusion will result.

However, this variation in terminology is not confined to the title mentioned, for it is even more pronounced in the bridge and building department. Here the titles of supervisor of bridges and buildings, master carpenter and chief carpenter are used interchangeably in the United States while the title of master of bridges and buildings is common in Canada. The title of master carpenter or chief carpenter is, of course, a relic of the days of wooden structures, and is not sufficiently inclusive to designate an officer who is responsible also for concrete and steel structures.

Railway operation will be simplified and confusion eliminated by the universal use of common titles to indicate the same relative degrees of responsibility. The action taken by the Illinois Central is a constructive step in this direction. We trust that the time will come when the chief maintenance officer on a division will be universally known as the division engineer, and his immediate assistants will carry the titles of supervisors of track, supervisors of bridges and buildings, supervisors of water service, etc., which are fully discriptive of the duties they perform.

The Railways' Contribution to Industry

The economic contribution made by the railways, in the form of capital expenditures, material purchases, wages, tax payments, interest and dividends, aggregated nearly six billions of dollars in 1928. The distribution of this vast sum provided a direct livelihood for more than a million and a half railway employees, their families and dependents; provided employment indirectly for at least as many more persons through large purchases and capital expenditures widely distributed among different industries; kept the wheels running in many an industry and industrial plant that would otherwise lie idle; bore a substantial share of the annual cost of federal, state, municipal and local governments; in brief, stimulated the business activity of the United States at thousands of points and in a thousand ways.

Organizing to Fight Snow

MAINTENANCE of way officers have a wider variety of snow fighting equipment at their disposal today than their predecessors of a generation ago, all of which greatly reduces the amount of hand labor required. But this more modern equipment has not decreased the importance of a properly organized snow fighting force, particularly in large yards and terminals.

The first requirement of such an organization is that when the emergency arises, every man shall know his place and the duties he is to perform and, if necessary, shall be able to handle his part of the work with only the most general supervision. In large yards and terminals it is seldom practical to maintain a normal force of sufficient size to cope with heavy snow storms, so that the problem of augmenting the regular forces and providing the necessary foremen when the emergency arises is one of major importance. The problem of organizing these forces is worthy of the most serious study, especially as reserves must frequently be held in readiness to relieve both regular and extra gangs that have been on duty up to the allowable limit of time.

The planning for snow fighting also includes arrangements for the assembly and distribution of such small tools as brooms, shovels, hydro-carbon cans, scoops and snow pushers; the assignment and use of snow plows, flangers and spreaders; the feeding of the men; the perfecting of the general supervision of the entire operation, as well as the local supervision of the gangs in individual yards or sections of the terminal; arrangements for reports of conditions at regular intervals; the calling of the regular men if the storm begins at night; arrangements for keeping in touch with the transportation and mechanical departments; maintaining a liaison with the stores department; collecting tools from gangs that are relieved and re-issuing them to other gangs; loading or otherwise disposing of surplus snow and numerous other items that must be covered by any well considered plan.

These plans should be made far enough in advance of the first snow to insure that every man shall be informed of what is expected of him and that all neces-

sary supplies shall be on hand. The fact that an organization has functioned satisfactorily one winter is no assurance that it will function in the same manner the next, unless the same process of planning and issuing of instructions is carried out as at first. This can best be done by calling a conference of all of those who are to have charge of the various details of the work, so that there shall be no question that the plans and instructions are fully understood before the emergency occurs.

Uniform Expansion in Winter

JUDGING from the magnitude of the orders already placed for next year's requirements, more rail will be laid during the coming winter than at this season in any previous year. This emphasizes the importance of taking adequate precautions to insure uniform expansion at all rail joints. The maintenance of uniform expansion is fully as important in the winter as in the summer. While there is no danger of the track buckling in cold weather, irregular expansion throws excessive shearing stresses on the bolts in the open joints, thus increasing the probability of broken bolts. Wide expansion also increases the batter at the rail ends.

The measures which should be used are the same as at any other season, consisting of temperature readings of the rail and the use of expansion shims to correspond with these temperatures. The rail should butt snugly against the shim as it is set in, and the shims should be allowed to remain in place until enough rails have been laid in advance, so that the expansion will not be disturbed in those already laid. To insure that this expansion will be maintained, the joint fastenings should be put on and the bolts tightened, while sufficient anti-creepers should be applied to the rail immediately, to prevent creeping.

On rail that is already in service, irregular expansion can be overcome by driving the rail, applying new joint fastenings, tightening bolts, or increasing the number of anti-creepers at places where the rail shows a tendency to pull apart. Sometimes it may also be advisable to slack off on the bolts at joints that appear to be "frozen." Where this is done, extreme care should be used to avoid wide gaps as the result of sudden contraction in a group of rails which have frozen joints.

Another Active Year in Sight

ONE OF the most outstanding examples of constructive statesmanship which this generation has witnessed was President Hoover's action in calling together the leaders of the country's basic industries to quiet the hysteria which was developing in some quarters following the collapse of the speculative boom in the stock market. It is not without significance that the first group to which he turned for counsel and cooperation was the railway executives. By this action, he manifested an appreciation of the place of the railroads in industry and the progressive type of its leadership. That this confidence was well placed has been shown by the whole-hearted response of the chief officers of the roads.

In a message transmitted to the President on November 22, they pledged their support in prosecuting a program of improvements next year that will equal and probably exceed the large program of this year. Coming as this assurance does after seven years of unparalleled activity in the improvement of railway facilities, during which time approximately $5,500,000,000 has been expended for additions and improvements to existing facilities, it demonstrates confidence in the future business outlook of the country in no uncertain terms.

The year now closing has been one of unusual activity. Before the year ends, the roads will have spent approximately $800,000,000 for improvements, a figure that has been exceeded only twice in their history. In the maintenance of their roadway facilities the comparison is even more striking, for the expenditures for the first nine months of the year have exceeded those for the same period in any previous year with the single exception of 1927, in which latter year the expenditures were only one per cent larger than in 1929. With the continuation of this active program assured, it is evident that next year should be one of unusual activity for railway and railway supply men alike.

A Rule a Day

EVERY road is confronted with the problem of insuring that its employees are familiar with the rules that have been formulated for their guidance and protection in the performance of their work. To this end the men are subjected to examination from time to time. Yet occasions constantly arise which reveal a lack of familiarity with the rules, as a result of which an accident, or some objectionable condition is brought about.

To correct this situation the maintenance of way department of the Missouri Pacific has inaugurated the practice of insisting that one maintenance of way rule and one safety rule be read and discussed in each gang every day. To make this effective, the maintenance officers prepare a list of these rules, grouped by days, which list is placed in the hands of each foreman before the first of each month. This practice is commendable, for it insures familiarity with at least a limited number of rules, and over a period of time will cover all of the more important requirements. It also keeps the question of rules constantly before employees and focuses attention on the necessity for their observance.

Is a Track Walker Necessary?

ONE OF the precautions observed by maintenance of way officers of many roads has been to employ track walkers to patrol heavy-traffic main tracks for the purpose of looking for and correcting unsafe conditions before they lead to accidents. Employed first at points subject to slides or other special hazards, their use has extended over entire divisions of numerous heavy-traffic lines.

Until a few years ago, maintenance of way men complained constantly that the steady increase in size and weight of rolling stock was reducing the factor of safety of the track to the danger point and in such instances the track walker was a necessary precaution. Of late, however, there has been a rapid strengthening of the track structure, with the result that the track of today is far stronger than that of a few years ago, even in relation to the loads placed on it. At the same time there has been a marked improvement in the standards in maintenance of cars and locomotives, with the result that they give less trouble on the road than ever before.

These developments, and particularly that of the track structure, are causing not a few maintenance officers to question the necessity of continuing the track walker in other than locations of special trouble. One such road, the Lehigh Valley, has concluded that, with its present heavy track construction and its high standards of maintenance, it is no longer warranted in in-

curring this expense and has recently dispensed with its track walkers, with an immediate appreciable saving in expenditure for labor. This question is not without interest elsewhere.

Tools for Water Stations

ONE OF THE controversial subjects which has been discussed at length for many years, but about which little has been done, is that of providing pumpers at railway water stations with such tools as will enable them to make certain classes of repairs to the machinery in their charge, and thereby avoid, in many cases, the necessity of sending repairmen out on the road at inconvenient hours.

Continuity of train movement cannot be maintained without an ample supply of water and the results of even a single water failure may be far reaching and costly. For this reason, the importance of keeping the pumping machinery in operating condition at all times is recognized by the water service department, which is charged with the responsibility of maintaining a dependable supply of water. As a consequence, the repairmen in this department are keyed up to respond to calls for help first, and question the necessity of the call after the conditions have been ascertained. The result of this situation is that considerable unproductive time is applied in water service repair work, which could be eliminated if the pumpers were able to make minor repairs to the pumping machinery as necessity arises, or temporary repairs in those cases where more serious trouble occurs.

Many water stations are located at isolated points which it is difficult for a repairman to reach promptly. When he does arrive, he not unfrequently finds that the repairs needed are of a character which could have been made by the pumper if he had been supplied with an adequate outfit of tools. It is true that not all pumpers are equally competent, and that the railway is frequently compelled to select men for this position who have little ability or initiative and practically no knowledge of the machinery they are operating. In many other cases, however, and these include by far the greater number of pumpers, these men are not only willing but take pride in keeping their equipment in first class condition.

Men of the latter type should be encouraged to keep their plants in good repair, so that the visits of the repair men become more a matter of routine than an answer to emergency calls. One of the best methods of stimulating this feeling is to supply the pumper with a complement of tools which are suited to his ability and the equipment in his charge. Where this plan has been tried, it has been found that pumpers take a greater interest in their work and demonstrate at once that they feel a responsibility for the condition of the equipment and its appearance, as well as the performance of the plant.

An objection often raised to the placing of tools in the hands of pumpers, as a matter of general practice, is that the cost for a railway as a whole is too great, and that the results are not commensurate with the expense. Every railway has some water stations where the providing of any tools beyond a hammer and a wrench would be a waste of money. On the other hand, there are numerous plants where the saving in the time of the repair men will more than offset the cost of the tools in a short time, while the increased life of the pumping machinery, which is certain to follow, is of no small consequence.

What of the Concrete Tank?

THE USE of reinforced concrete in the construction of water tanks was begun about 30 years ago. Since that time concrete has been used extensively for the construction of water containers in the form of reservoirs, settling basins, sewage basins, etc., but has had limited application in the building of elevated tanks. It is, therefore, of interest to note on page 541 of this issue, that one road has built several concrete tanks in recent years and is apparently well satisfied with the results obtained. The fact is significant for two reasons: The Duluth & Iron Range occupies a territory of severe winter; its experience with concrete tanks covers a period of 15 years, a sufficient time in which to learn much.

The failure of concrete water tanks to achieve general popularity must be ascribed to doubt as to their economic justification, in view of their relative cost as compared with wood and steel tanks, and the unfavorable results obtained with some of the tanks that have been built. This raises the question as to why some concrete tanks have given poor service.

One reason for poor tanks is without doubt poor concrete, because water, the enemy of poor concrete, is given unlimited opportunity to carry on its processes of disintegration in a tank. Faulty design, particularly as to such details as the joints, is also a contributing factor. But some engineers have gone so far as to contend that concrete is inherently unsuited to use in a tank. They point to the fact that the bursting effect of the water pressure can be resisted only by the tensile strength of the ring reinforcement (corresponding to the hoops of a wooden tank) and that the concrete can serve only as an inert filler to encase the reinforcement. Furthermore, they cite the fact that concrete surrounding steel under normal working tensile stresses is subject to incipient failure through the formation of many minute cracks and contend that this will cause leakage.

There is no justification for poor concrete if the knowledge of concrete making now available is put into practice. The fact that excellent results have been obtained by the D. & I. R. is proof that the concrete in its tanks was carefully made; in fact, the article cited above records the special pains taken in the proportioning, mixing and placing of the concrete. That the tanks do not leak should be ample proof that the theoretical questions raised as to the suitability of concrete in tanks may be disregarded. It is true that the article records some difficulty with the joints between the sides and bottoms of the tubs, but the development of such details is a matter of experience, and it is apparent that the D. & I. R. has met this difficulty with a reasonable degree of satisfaction.

This leaves the question of economic justification, which embraces such other questions as relative first cost and maintenance expenses, relative life, and the possibilities of realizing the full life of a tank under the changing conditions prevailing on a railway. The last question must be answered on its merits in each individual case, while answers to the others call for greater experience with concrete tanks than has been had to date. Such experience can be obtained only as more tanks are built.

TWENTY-FIVE YEARS AGO.—A 60-ft. section of the Atchison, Topeka & Santa Fe bridge over the South Canadian river at Purcell, Okla., which was washed away during a recent flood was found intact on the river bank near Calvin, having been carried more than 70 miles by the flood.—*Railway Age*, November 25, 1904.

A Billion Crossties*

What must be done to get a full return on what they cost

As told by R. S. BELCHER
Manager Treating Plants, Atchison, Topeka & Santa Fe System, Topeka, Kan.

R. S. Belcher

IT IS STATED that the total operated mileage of all tracks of the railways of the country in 1928 was 426,000. If we figure only 2,500 ties to the mile, exclusive of bridge and switch ties,—and probably this is a very low figure—it will be seen that there are more than a billion crossties in service on the railways of this country. Our problem, then, is to get the utmost service from every one of these ties.

A tie is something more than just a stick of wood. It is made to serve a definite purpose. Its functions are to hold the rails to gage and to distribute the loads to the ballast. Both the purchaser and the tie producer are interested in the details of its manufacture from the time the tree is cut. Careless or unskillful manufacture may make a poor tie out of a good piece of timber. To leave a good tie in the woods too long, or in a wet location, will ruin it so that it will not be worth treating. In short, it is to the advantage of everyone that the timber be suitable and meet specifications, that the tie be carefully made by a skillful tie hacker or sawmill operator to the railway's specifications and that it be moved promptly from the woods to the treating plant, where it can be seasoned under the most favorable conditions. A proper specification is necessary, of course, but the specification itself is not enough. To be effective, it must be enforced, and to be enforced there should be competent inspectors. While competent inspection is a necessity for the railways, I am sure the tie producers will be almost as much interested in this point, for incompetent inspection has been the cause of many of the trials and tribulations which they have undergone in the past. Ties should be hammer marked or otherwise branded with the grade, the inspector's number or letter, the month inspected, and the initials of the railway. Ties so marked can be sorted properly and piled when they reach the treating plant or other storage point. If the tie does not come up to the grade marked, the inspector may be identified.

Tie Treatment

This paper is prepared largely with the thought in mind that ties purchased are to be treated. In a comparatively few years relatively few crossties will be installed untreated, and those that are will be used in special locations. A total of 74,231,840 crossties were treated in the country in 1927. This is equivalent to more than 70 per cent of the ties purchased during that year, so that the question of whether it pays to treat ties appears to have been settled. The Santa Fe has been treating crossties for 44 years, starting in a small way with the treatment of about 100,000 in 1885, and to date a total of 90,000,000 ties have been treated. Ninety-nine per cent of the ties inserted in 1928 in Santa Fe tracks were treated, and we estimate that 94 per cent of all the ties under Santa Fe rails are treated ties, the remainder being largely redwood. Our first purchase of creosote in quantities was made in 1905, and to date 122,000,000 gal. of creosote have been received at Santa Fe plants. The general decrease in our tie renewals per mile of track during the past 30 years is evidence of the value of preservative treatment of crossties on the Santa Fe.

The railways, generally, are spending more money for the conditioning of their ties before treatment than formerly. A greater effort is being made to get the ties out of the woods without delay and into the treating plants where, in general, seasoning can be done more satisfactorily than elsewhere. Seasoning yards at the treating plants usually are well kept, free from weeds, well drained, and the ties are piled properly. Machine adzing for the tie plates and the boring of spike holes prior to treatment is standard practice on many roads and is increasing steadily. Of the 74,000,000 ties treated in the United States in 1927, 28.79 per cent were adzed and bored, 6.14 per cent were bored only and 5.22 per cent were adzed only.

How Does the Well-Treated Tie Eventually Fail?

With a view to possible improvement of our tie treatment on the Santa Fe, we have inspected thousands of old ties which have served their time, and have been taken out of track, for the purpose of determining just why they failed. Some ties, of course, show several kinds of failure in the same tie, but we have, so far as possible, classed them by what appeared to be the primary reason for failure under the following heads: Decay, spike killed, shattered, rail cut, plate cut, derailment, split, broken and burned.

The only one of these classifications which needs explanation is "spike killed." Ties so classed may show not only mechanical damage from the spiking, but also some little decay adjacent to the spike holes, the result of the crushing of the wood fiber and the entrance of moisture at this point. This decay, later, may extend through the untreated interior of the tie, thus becoming an important factor in the ultimate failure of the tie, but, after all, the spiking is the primary cause of failure of such ties.

Decay, spike killing and shattering account for most of the ties which have come out of our tracks in the last ten years. Only small percentages are covered by the other headings. Of the untreated ties, 80 per cent

*Abstracted from a paper read before the convention of the Roadmasters' and Maintenance of Way Association at Chicago on September 18.

Track between Hemon, Okla., and Mooreland, Atchison, Topeka & Santa Fe

were taken out because of decay, 7 per cent were spike killed and 7½ per cent were shattered. Of the zinc-chloride treated ties, 60 per cent were decayed, 8 per cent were spiked killed and 30½ per cent were shattered. Creosoted ties showed only 0.5 per cent decayed, 49½ per cent spike killed and 44 per cent shattered.

There are comparatively few untreated ties now in Santa Fe tracks and zinc-chloride treated ties inserted during the war period are gradually being replaced, so that it is to the creosoted ties that we turn with most interest in the above percentages. Decay, except as incidental to spike killing and shattering, seems to have been pretty well eliminated, and we are now directing our campaign against spike killing and shattering.

Cross Ties Treated by the Santa Fe from 1885 to 1928

Year	Number of Ties Treated	Cubic Feet of Ties Treated	Cubic Feet of All Material Treated	Per Cent of Cu. Ft. of Ties to All Material Treated
1885	111,503	446,012	446,012	100.00
1886	333,298	1,333,192	1,333,192	100.00
1887	189,386	757,544	757,544	100.00
1888	285,104	1,140,416	1,140,416	100.00
1889	169,174	676,696	676,696	100.00
1890	105,753	423,012	423,012	100.00
1891	128,568	514,272	514,272	100.00
1892	187,270	749,080	749,080	100.00
1893	178,167	712,668	712,668	100.00
1894	247,566	990,264	990,264	100.00
1895	288,760	1,155,040	1,420,102	81.33
1896	336,070	1,344,280	1,499,696	89.63
1897	676,804	2,704,242	3,011,808	89.78
1898	1,340,103	5,372,903	5,880,344	91.37
1899	2,302,672	9,186,112	10,191,616	90.13
1900	2,645,219	10,191,457	11,390,293	89.47
1901	1,447,040	4,757,468	5,404,648	88.03
1902	2,071,649	6,706,313	8,054,312	83.26
1903	2,249,076	7,250,125	9,154,821	79.19
1904	3,294,962	10,598,433	12,121,085	87.44
1905	2,479,551	8,156,048	9,414,742	86.63
1906	2,124,013	6,828,684	8,550,037	79.87
1907	3,135,428	9,357,833	11,429,932	81.87
1908	3,826,963	12,290,748	13,639,694	90.11
1909	2,851,717	9,578,731	11,723,358	81.71
1910	3,317,621	9,446,723	11,900,660	79.38
1911	3,168,581	10,003,250	11,435,836	87.47
1912	3,291,925	10,569,732	11,666,727	90.60
1913	3,014,972	9,586,677	12,084,026	79.33
1914	2,359,143	7,181,954	8,280,561	86.73
1915	3,008,330	9,350,900	10,383,581	90.05
1916	3,228,862	10,387,147	12,194,401	85.18
1917	2,720,032	8,769,670	10,162,116	86.38
1918	1,627,232	5,073,696	6,698,549	75.74
1919	2,059,984	6,714,784	7,688,450	87.34
1920	2,168,273	7,326,745	8,668,987	84.52
1921	5,460,199	16,250,634	16,752,584	97.00
1922	1,179,786	3,391,628	4,078,126	83.17
1923	3,182,268	7,362,068	9,500,760	77.49
1924	3,137,875	10,009,057	12,740,642	78.56
1925	2,731,799	8,923,528	10,703,086	83.37
1926	1,981,722	6,536,042	8,568,182	76.31
1927	4,191,182	13,449,905	16,673,507	80.67
1928	3,903,925	12,382,562	14,798,570	83.67
Total	89,628,527	285,938,275	335,608,995	85.20

The ties which were included in the spike-killed ties mentioned were, in general, ties which had not been prebored for the spikes. We are preboring and preadzing all ties before treatment on the Santa Fe and, as I have already mentioned, this is considered good practice on many of the railways of this country. Without doubt, when the spike is driven into the treated, prebored hole, a big step has been taken toward protecting the tie from the crushing of the wood fiber and decay around the spike, in so far as the first spiking is concerned, but what of the numerous other spikings incident to rail laying, regaging, spacing ties, etc.?

Ordinarily prebored ties should have four holes bored at each end of the tie. This will permit reversing the spiking at some time during the life of the tie. The additional treatment in the tie by reason of the prebored holes is also of much benefit, for this additional preservative goes to the spot where it will do the most good—at the rail base. By all means, any unnecessary spiking should be eliminated and the necessary spiking should be carried out with greater care than is usually the case. Spikes should be driven vertically, square with and snug against the rail, and where prebored ties are used it follows that, to obtain the advantages of preboring, the holes in the tie plate must be lined up with the spike holes in the tie, so that the spikes may be driven into the bored holes as intended.

When respiking, it is important that a well manufactured tie plug be used. A poor tie plug, in many cases,

We use a great many pine and fir ties, and both of these woods shatter badly under certain conditions. We have found that the addition of petroleum residuum, or fuel oil, to either the creosote treatment or the zinc-chloride treatment will do a great deal towards preventing shattering. As a result of experiments starting in 1909, the creosote-petroleum-mixture treatment was made standard on the Santa Fe in 1923. We hope that this treatment, together with careful distribution of ties of the various woods to those parts of the system where each will give best results, will do much towards overcoming shattering. A total of 15,791,147 crossties, or approximately 21 per cent of the ties treated in the United States in 1927, were treated with creosote-petroleum mixtures, 15 railways using this preservative.

Preboring Is Good Practice

is worse than none and does considerable damage to the tie. It is particularly important that the tie plugs be uniform in size.

Adzing Ties in Track

In the course of track work, it is often necessary to adze treated ties for plates, gaging, to eliminate wheel marks and for other reasons. When this is necessary, the swabbing of the adzed surface with a hot preservative composed of 50 per cent creosote and 50 per cent

Santa Fe Track in Oklahoma, 100 Per Cent Treated Ties

petroleum residuum, creosote-coal tar solution or straight creosote, will be found good practice and well worth the trouble and expense of the application and of keeping the preservative hot. Several types of heaters have been developed which are convenient to use.

A few days ago, an advertisement of one of the large tie and treating companies in a railway magazine came to my attention. A picture in the advertisement shows

Average Number of Ties Inserted Per Year and Weighted Average Total Ties Inserted, for Five Year Period
A. T. & S. F. Ry. Co. System

Years	Total Miles	Total Ties Inserted for Renewals	Total Ties Inserted Per Mile	Average Total Ties Inserted for Renewals for Five Year Period	Weighted Average Ties Inserted for Five Year Period
1898	8,490	2,796,946	330	.....	.....
1899	8,631	2,304,170	267	.....	.....
1900	9,028	1,751,271	194	.....	.....
1901	9,636	1,598,711	166	.....	.....
1902	9,842	1,993,463	203	2,088,912	229
1903	10,480	2,394,218	228	2,008,367	211
1904	10,636	2,822,314	265	2,111,995	213
1905	11,485	2,868,808	250	2,335,503	224
1906	11,922	2,364,105	198	2,488,582	229
1907	12,257	3,488,170	284	2,787,532	245
1908	12,519	3,778,633	302	3,064,406	260
1909	12,980	3,775,937	291	3,255,131	266
1910	13,811	3,904,079	282	3,462,185	273
1911	14,216	3,835,457	270	3,756,455	286
1912	14,831	3,281,027	221	3,715,027	272
1913	15,112	2,957,694	196	3,550,839	250
1914	15,664	2,818,816	180	3,359,415	228
1915	15,973	3,283,120	205	3,235,223	213
1916	16,151	3,206,763	199	3,109,484	220
1917	16,217	2,595,548	160	2,972,388	188
1918	16,489	2,579,356	156	2,896,721	180
1919	16,645	2,457,031	148	2,824,364	173
1920	16,885	2,753,673	163	2,718,474	165
1921	16,900	2,514,325	149	2,579,987	155
1922	17,005	2,693,905	158	2,599,658	155
1923	17,346	2,229,201	128	2,529,627	149
1924	17,709	2,046,054	116	2,447,432	143
1925	18,055	1,936,497	107	2,283,996	131
1926	18,474	2,156,360	117	2,212,403	125
1927	18,946	2,496,426	132	2,172,908	120
1928	19,252	3,002,391	156	2,327,546	126

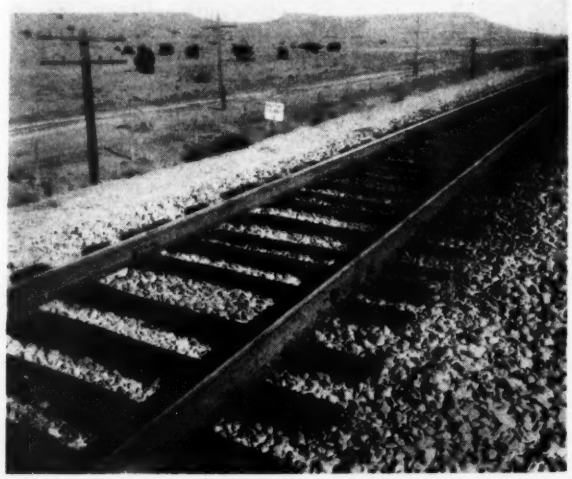
creosoted short-leaf pine ties which have been in a street railway in the South for 25 years, over which new rail is now being laid, and the advertisement stated that the street railway company expects to get at least 20 years more life from these ties, a total of more than 45 years. While, no doubt, these ties were subject to less mechanical wear than the average steam railway tie, yet they present this fact, that the well treated tie will resist decay indefinitely if it can be well protected mechanically.

In recent years there has been much improvement in tie plate design, whereas, in former years, many ties were taken out of track because of rail cutting or the damage done by small or poorly designed tie plates. Improved track drainage and the resultant elimination of much regaging, the use of improved ballast, rail anchors, tie spacers, and other devices which tend to reduce or eliminate the abuse to which ties were formerly subjected in handling or after they were placed in the tracks, have resulted in added protection to the tie mechanically. Nor should the fact be overlooked that the methods of handling the ties, of storing them, and of placing them in track, have improved. Much of the credit for the improvements in these methods and also in the design of tools and plates, anchors, spacers, etc., should be given to the roadmasters and the track men under them.

The thought that I would particularly like to leave with you is this: Increased length of service from well treated ties must be accomplished by improved protection against mechanical wear in both methods and material. The roadmasters and track men have accomplished much in this direction in the past, and it is to them we must look, to a large degree, for longer service life from our crossties in the future.

Discussion

In the discussion of this paper, J. B. Martin (N. Y. C.) asked what, if anything, can be done to prevent the checking of ties before and after treatment? Mr.



Texas Pine Ties on the Santa Fe, Creosote-Petroleum Treatment, After Five Years' Service

Belcher stated that it is difficult to prevent the natural checking of ties during the period of seasoning, but that S and Z-irons and other anti-splitting devices of similar character have been used with considerable success. He said these devices may not prevent the formation of small checks and that no method has yet been found which will satisfactorily overcome this action during seasoning, except what can be done by proper piling. In general, close piling is needed in a dry climate, in order to prevent the too rapid drying out of the wood, while in damp climates open piling is necessary in order to stimulate the drying out process, but that because of the slow seasoning, checking is less troublesome. He said that where these anti-checking

devices have been applied to the ties before the first seasoning, they are still effective during the period of seasoning after treatment. In some instances, however, ties which have not checked noticeably during either of the seasoning periods mentioned show a disposition to split quite badly after they are placed in the track. In such cases the only successful remedy which has been found is that of banding.

S. A. McCall (M. P.) asked why zinc treated ties frequently broom after they are applied in the track. Mr. Belcher stated that this is probably caused by the water used in the zinc chloride treating process and

Creosoted Ties Give Long Service on the Santa Fe

that, in such ties, the second period of seasoning is very necessary before the ties are sent out for application. The petroleum mixture, when used with the zinc chloride process, has been found the best preventive of this trouble. He also stated that some of the men in the wood preserving industry believed that the brooming which occurs may be the result of some characteristic of zinc chloride itself, but that no definite data have been secured to indicate that this theory is correct.

W. F. Hofford (U. P.) inquired as to how soon after treatment ties might be inserted in the track without impairing their usefulness and whether they are usually seasoned at the plant or allowed to season after distribution along the line. Mr. Belcher replied that his experience indicates that ties should be seasoned at the plant before shipment, because the seasoning can be carefully controlled, whereas, if they are allowed to season on the right of way, they meet a wide variety of conditions, most of which are unfavorable. He stated that creosoted ties should be allowed to season at the plant not less than 60 days before shipment. If this is done, the surface dries somewhat, so that these ties are not so difficult to handle in unloading, and also, because certain methods used at times in treating cause a temporary impairment of the strength of the tie, this period is needed. Where such ties are allowed to season under properly controlled conditions they will regain the strength lost in the cylinder. This is the regular practice on the Santa Fe, and this road receives very few complaints from the men who handle the treated ties after they are shipped from the plant. He said that he remembers only one case in 15 years where any of the men have suffered from the handling of cresoted ties, while, where the ties are shipped immediately after treatment, the fresh creosote sometimes affects the men handling them, and this is much more noticeable on persons of light complexions than those who are dark. As a result, there is little or no effect on the Negroes or Mexicans, who constitute a considerable part of the labor in some sections of the country.

Capital Outlays Have Been Larger in 1929

THAT the railways are continuing to appropriate large sums for additions and betterments to their properties, is shown in a statement prepared by the Bureau of Railway Economics and made public in connection with the annual meeting of the Association of Railway Executives in Chicago on November 22. From this statement, it is evident that the capital expenditures for the full year will be greater than the outlays in either 1927 or 1928. While the increase in the expenditures in the present year resulted in part from large outlays for equipment, much of the increase is due to larger expenditures for additions and betterments to roadway and structures.

Capital expenditures actually to be made this year are estimated at $800,000,000. This will be an increase of approximately $123,000,000 above such expenditures in 1928 and about $28,450,000 above those in 1927. Capital expenditures to be made this year are close to the annual average of the past six years.

The estimate as to expenditures in 1929 is based on reports received by the bureau which showed actual capital expenditures of $573,820,000 in the first nine months of 1929, compared with $500,167,000 in the same period in 1928, an increase of $73,653,000 or nearly 15 per cent. The total capital program, as authorized up to October 1, was $1,247,792,000 in 1929, an increase of $345,485,000 over 1928. This program may increase still further by additional authorizations between October and the end of the year.

Roadway and structures expenditures aggregated $363,131,000, compared with $334,200,000 for 1928, an increase of $28,931,000 or 8.7 per cent. The expenditures for additional tracks in the first nine months in 1929 amounted to $90,561,000, compared with $91,241,000 during the corresponding period last year. For heavier rail, expenditures total $33,995,000 compared with $34,891,000 in the first nine months of 1928. For shops and engine houses, including machinery and tools, expenditures totaled $23,838,000 compared with $22,375,000 in 1928. Expenditures for additional ballast showed a decrease from $12,621,000 in 1928 to $11,533,000 in 1929. For all other improvements, $203,204,000 were expended in the nine months period this year compared with $173,072,000 for the same period in 1928.

Total orders for freight train cars to October 1, including those on order at the beginning of the year, were 91,581, nearly twice as many as in 1928, and considerably greater than in 1927. Locomotive orders to October 1 were 1,565, and were 364 greater than in 1928, but slightly less than in 1927. Passenger train car orders to October 1, were 2,701, this particular total being lower than in 1928, but larger than in 1927. The total capital expenditures during the first nine months of 1929 devoted to purchase of new equipment was $210,689,000 compared with $165,967,000 for the corresponding period of 1928, an increase this year of $44,722,000 or 26.9 per cent above the preceding year.

"These capital improvements," according to the statement of the Bureau of Railway Economics, "comprise one form of distribution by the railways which benefits many industries and their employees, and leads to activity in many lines of manufacturing and trade. It has been estimated that the railways, through their capital expenditures and their utilization of fuel and other materials on a large scale, support as many employees of other industries as they directly employ in their own business."

Floating Concrete P

Solves Drainage Ins

The Outside of the Bulkhead as Assembled in the Pipe

Specially designed collapsible bulkheads provide means of placing three long 68-in. by 74-in. lines under water successfully on the Boston & Maine

IN CONNECTION with the extensive improvements which the Boston & Maine has been making during the last few years at its Boston terminal, and, more particularly,with the extensive filling work which has been done to eliminate timber pile trestles within the terminal area, about 3,000 ft. of large-diameter concrete drainage pipe was installed under water recently by a method which involved a number of unique features. In this work, as much as 200 tons of pipe were floated into place at a time, employing specially designed bulkheads which proved unusually effective.

The Boston & Maine's terminal at Boston comprises about 470 acres just across the Charles river in Cambridge, Sommerville and Charlestown, which, about 100 years ago, was largely under water. Necessarily, therefore, a large part of the terminal is on "made" ground, and, until the beginning of the recent improvements, approximately 65 acres of the terminal was actually supported on piling.

Closing River Channel Necessitated Pipe Drains

In an effort to reduce the area of pile structures at the terminal, many acres of trestles and pile bridges have been filled in within the last three years. At most points this was merely a problem of filling with earth, secured in cutting away a large hill located within the terminal area, and was done without difficulty and without interfering with existing water rights and channels within the terminal area. The most unusual problem encountered in this work was in connection with the closing off of a channel about 1,000 ft. in length, connecting what is known as the Miller River basin in the center of the terminal, with the Charles river.

As it was impossible to isolate the river basin entirely from the waters of the Charles river by filling in the channel, owing primarily to the necessity of maintaining a water outlet for the Miller river, which empties into the basin, it was decided to install sufficient drainage pipe in the bottom of the channel to carry the water, and then to fill the channel to the yard level. A study of the problem resulted in a plan for installing three lines of reinforced concrete pipe, elliptical in section, with a short diameter of 68 in. and a long diameter of 74 in. Depending upon the stage of the tide in the Charles river, the water in the channel ranged from about 6 ft. to 16 ft. in depth, a condition which promised to cause difficulties in installing the pipe by usual methods.

Floating Pipe Into Place Found Most Feasible

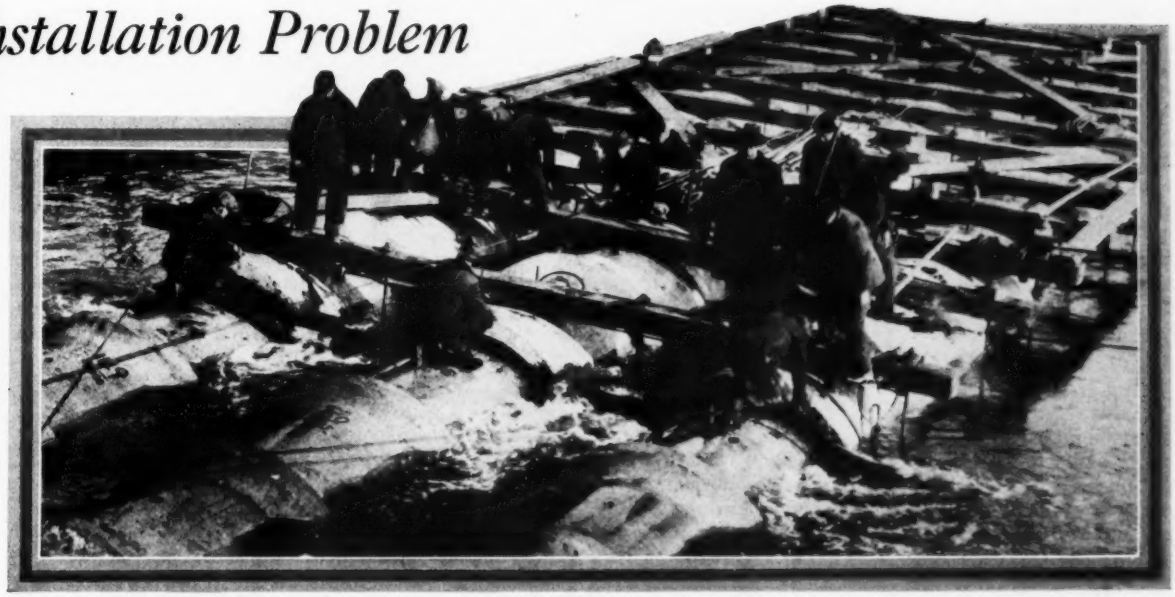
Many methods were considered for placing the pipe, and while the use of hoisting equipment seemed the most logical, this would have been possible through only a short section of the work, owing to the shallow clearance provided under two bridges, and the narrowness of the channel at certain points. After the requirements had been definitely formulated, the problem of installing the pipe was turned over to a contracting company, which immediately discarded the method of placing the pipe by cranes or derricks, and made a study of the possibility of floating the concrete sections into place. As a result of this study, an ingenious type of collapsible bulkhead was hastily devised, which made it possible to float multiple sections of the drainage pipe into place, and lower them into position with a minimum amount of difficulty and expense.

In carrying out the work, a material yard was arranged at one end of the channel, with a suitable dock for building up the sections of the pipe line to be floated into position later. As three parallel lines of pipe were to be provided, the usual plan followed consisted of building up the pipe floats with three lines of pipe, each line consisting of from four to twelve 6-ft. sections of pipe, and having an over-all length of from 24 to 72 ft.

At the material yard the float units were assembled on a construction dock with an elevation just above mean water level. So located, it was possible to work clear of the water during low tide, and at the same time be sure of sufficient water at high tide to float the pipes. In assembling the pipe floats, the various sections of pipe were lined up upon specially designed rafts consisting of longitudinal and transverse timbers securely bolted together, and the joints of all of the sections were calked with oakum and

Pipes into Place

Installation Problem



Joining Up a Heavy Float of Concrete Pipe in the Channel

filled with Velo early strength cement. As completed, a more or less similar raft was constructed over the tops of the pipes, and securely tied to the lower raft by means of steel tie rods. This arrangement insured the maintenance of true alinement of the three pipe lines making up the float.

Special Design of Bulkhead Was Used

The key to the problem of floating the pipe sections into place was, of course, the use of bulkheads in the end sections of each line of pipe on the floats, and while certain bulkheads of common design might possibly have been used, the contractors developed a special type of bulkhead with a number of distinctly new and advantageous features, which was used with an unusual degree of success. The special bulkhead also proved unusually economical, not only because of the fact that it was capable of ready assembly and installation in the pipe, but, of larger importance, because it could be removed from the submerged pipe without the employment of a diver, and was capable of repeated use.

In the new type of bulkhead, many of the features of which have been covered by patent applications, the outstanding feature was that it was readily collapsible. Essentially it consisted of eight specially built-up pieces of wood, so designed that, when assembled, they filled the elliptical section of the pipe snugly and were capable of resisting any water pressure exerted upon them. These eight pieces included four triangular pieces which assembled in the form of a low pyramid in the center of the bulkhead, and four special segments which acted as foundations for the pyramid formation and as fillers between the bases of the pyramid center and the wall of the pipe.

In order to make up the bulkheads economically, and, at the same time, to insure their being entirely waterproof, the filler segments were constructed of four layers of two-inch plank, spiked together with layers of tar-saturated roofing felt between them. Likewise, the larger triangular sections were of similar construction, except that only three layers of two-inch plank were used.

In a further effort to insure the watertightness of the bulkhead as assembled, irrespective of slight variations which might exist in the diameters of the various pipe sections, each of the triangular sections was fitted on its three sides with a moulding, cut to a special curve, spiked over a one-half inch strip of felt saturated with tar. This provision invariably brought the various sections of the pyramid and the filler pieces into line contact with each other, regardless of fluctuations in the diameters of the pipes, but, as a further precaution, all joints were lightly calked with oakum and then pitched when the bulkheads were assembled.

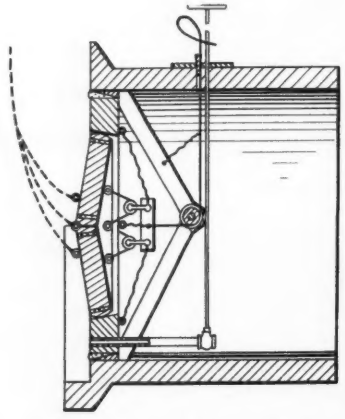
Ingenious Method Used to Hold Bulkheads in Pipe

One of the special features of the bulkhead was the method of holding it securely in place in the pipe, irrespective of the water pressure which would come into play while the pipes were being floated and submerged. In the first place, a continuous line of wedges were driven between the periphery of the bulkhead and the wall of the pipe. Tightening and holding the triangular sections in place after the frame was removed was accomplished by means of an equalizing mechanism, consisting of short lengths of cable and two small sheaves tied to an equalizing bar. With the cables hooked into eyes provided in the rear faces of the triangular sections, tension on the equalizer bar drew all of the triangular sections together with a uniform force, which, in turn, caused a uniform pressure to be exerted by the bulkhead around the wall of the pipe.

Tension on the equalizer bar was brought about by pull on a cable attached to the bar and made to pass over a sheave held in a simple A-frame, mounted di-

rectly back of the bulkhead inside the pipe, the legs of the A-frame having support against the inside face of the bulkhead near its outer edge. From the sheave, the cable was carried up vertically through a small hole provided in the top of the pipe by the pipe manufacturer for handling purposes, and through a steel plate. Final tension on the equalizer cable was exerted by attaching it to the hoisting hook on the locomotive crane employed at the assembly dock. When sufficient tension had been brought on the cable, a single steel wedge was driven into the cable hole in the steel plate at the top of the pipe to hold the cable under tension after it had been disconnected from the locomotive crane.

Another important feature of the assembled bulkhead was the provision of a two-inch pipe through the segment at the bottom of the pipe, which extended to a valve located about three feet inside the pipe. Operation of the valve was by means of a long stem, substituted for the usual short valve stem, which extended up through the same hole in the pipe as the equalizer cable, and through a separate hole in the steel plate, and terminated in a handle. The purpose of this valve was to admit water slowly to the pipe in the sinking operation.



Above—A vertical cross section through the bulkhead, showing the equalizing arrangement

Right—Floating a raft of pipe into place. View shows the congested condition about the channel

Little Difficulty in Launching and Setting Pipe

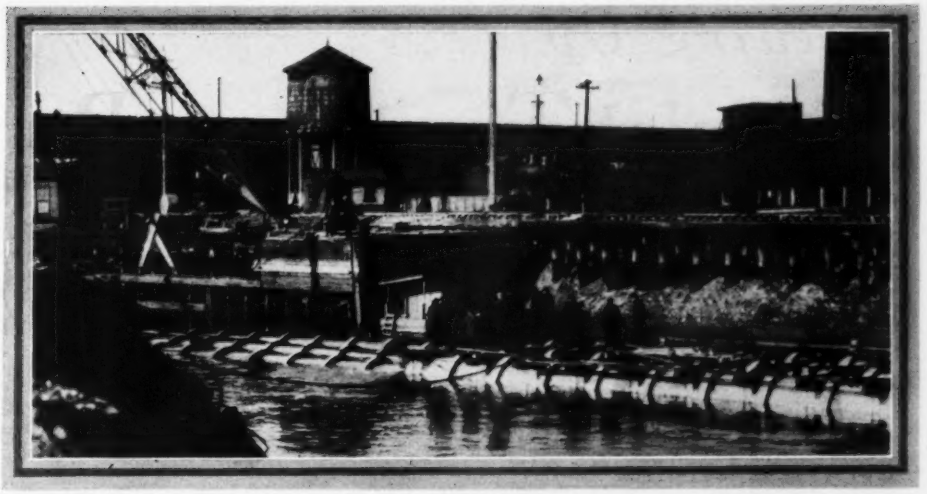
In building up the pipe floats, the first sections of each of the three lines of pipe were thus fitted with bulkheads, and subsequently, the additional sections of pipe in each line were placed and the joints calked. The last length of pipe in each assembly was likewise fitted with a bulkhead, similar to the one placed in the first length, so that when this length was placed, the float was ready to be launched and moved out into position.

Building up of the floats was done in the dry during low water, and to facilitate this, and to increase the amount of work which could be accomplished during the periods of low water, the bulkheads were placed in the end sections of pipe in advance of their being lined up on the raft. A small, hand-operated suction pump with its suction line extending down into the pipe through a hole cut in the top was provided in each line of pipe on a raft, and was used to keep any water pumped out which might seep into the pipes while they were being floated into place. As it actually worked out, there was little occasion to use the pumps, and they were provided mainly as a matter of precaution.

Floating of the pipes into place in the channel to be filled in was accomplished with little or no trouble from the first, and was soon done as a routine operation. With the rising tide, the watertight sections of the pipe line floated in a semi-submerged state and were towed into position and gradually sunk by the falling tide and by admitting water into the pipes through the valves provided in the bulkheads. Each successive float of pipe was lined up carefully with the pipe placed previously, and was made to rest on a level gravel foundation previously prepared in the bottom of the channel.

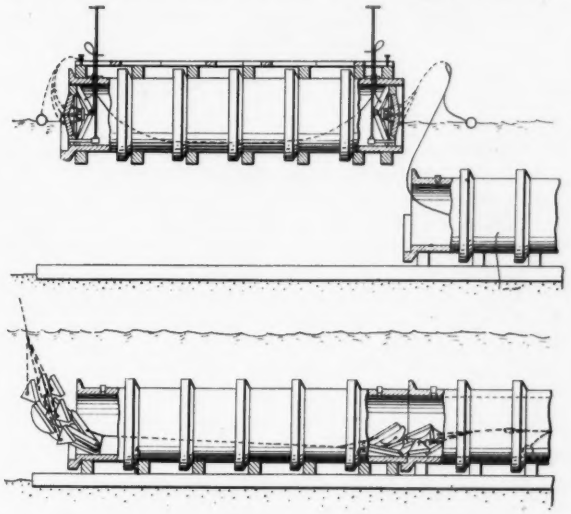
The greatest difficulty encountered early in the work was occasioned by the rapid current of water which poured through the pipes first placed in the channel, which made it almost impossible to pull the adjoining float of pipe into place. To reduce the flow of water in the pipes, and thereby reduce the pressure against the approaching bulkheads, temporary timber gates were provided to close off the upper ends of the pipes while the pipe floats were being brought up and lowered into position. These gates effectively overcame the difficulty encountered.

No attempt was made to remove the timbers forming the lower part of the raft, these being allowed to remain on the bottom further to assure permanent surface and alinement of the pipe. The top sections of the rafts were removed, however, by simply backing out the tie rods which held them to the lower sections.



Settling a long float of pipe to a connection with the three lines of pipe already in place

The only unusual feature in joining up the pipe floats in the channel was in connection with the fact that the floats had to be lowered vertically, which could not be done with the usual bell end provided on the concrete pipe. In the first part of the work, therefore, the bell formation on the end lengths of pipe in the floats was cut away to the center of the pipe so that as each succeeding float of pipe was brought up it could be lowered vertically into place. The cutaway portion of the bell joints was replaced after the pipes were lowered, by specially cast con-



Sketches Showing Arrangement of Bulkhead Rigs When a Float Was Ready to Be Lowered and How the Collapsed Bulkheads Were Removed

crete collars of the same shape as the portion of the bell joint removed. Later on during the work, the Massey Concrete Products Corporation, which furnished all of the pipe, supplied sufficient specially cast pipe with the upper half of the bell joint missing, together with suitable collars, making it unnecessary to cut away the interfering portion of the bell joints in the field.

The removal of the bulkheads from the finally located pipe floats was one of the most effectively worked out details in connection with the drainage work. This was done in each case by merely knocking out the wedge which held the equalizer cable under tension, and by pulling on another cable attached to the outer faces of the four triangular sections form the center of the bulkhead. It was made the more effective by reason of the fact that all of the various units making up each bulkhead were wired or chained together, so that, when broken up, all of the parts were kept together and readily recovered for reassembly.

The break-up pull on the bulkheads, inaccessible after the new lengths of pipe had been placed, was applied by means of cables which were carried forward through the pipe lines as laid. Just before a float of additional pipe was lowered into place, the cable in each line of pipe already in place was attached to a group of short cable lengths fastened together at one end, and hooked to the triangular sections of the bulkhead at the other end. When it was desired to remove the inaccessable bulkheads, therefore, it was only necessary to apply a sufficient jerk to the through cables at the distant open ends of the pipe lines.

Bulkheads Removed With Unusual Simplicity

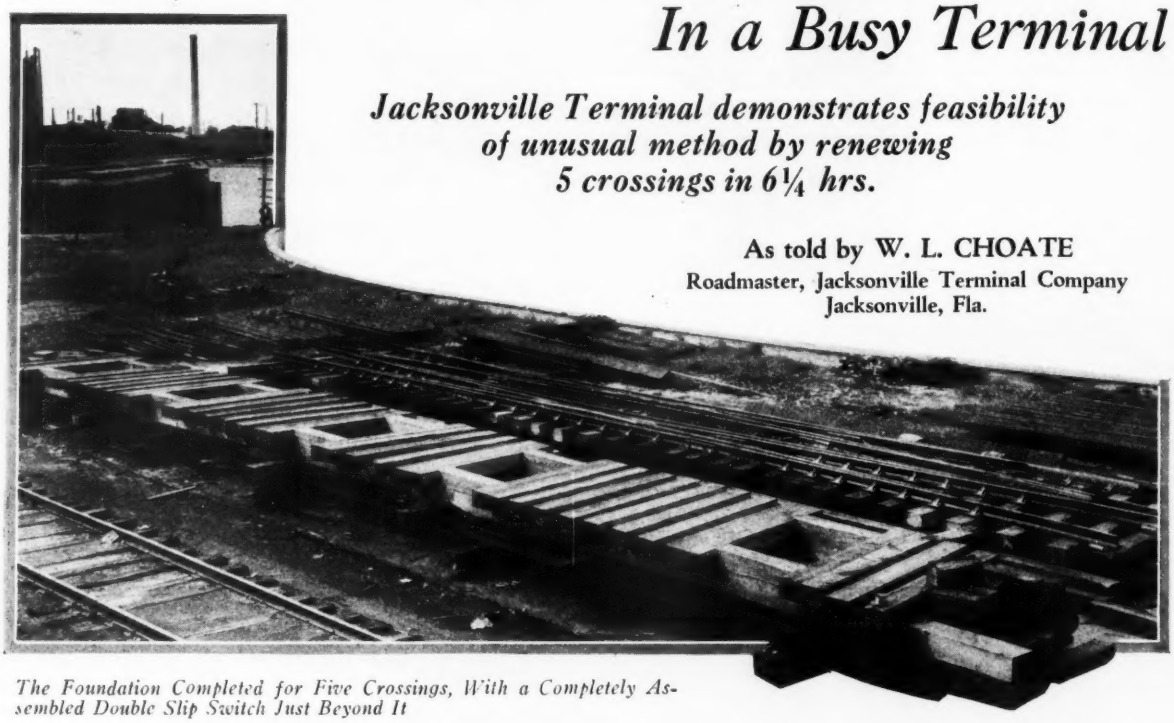
Collapsing of the exposed bulkhead in each line was usually done simultaneously with the collapsing of the inaccessible bulkhead, and then both bulkheads, in their collapsed state, were withdrawn from the pipe line through the end just laid. This latter feature was accomplished by having previously tied the two bulkheads together by means of a loose cable when they were originally installed in the floats, and was effective, not only in that it precluded the necessity of pulling the interior bulkheads back to the start of the line and then transporting them back to the construction dock, but also in that it provided a means of carrying forward the collapsing cables in each section of the pipe lines as laid. Following this procedure, the 1,000-ft. drain of three lines of large-diameter concrete pipe was laid without serious difficulty, from two to four pipe floats being placed each week, depending largely upon the condition of the tides.

All of the work was carried out under the general direction of W. J. Backes, chief engineer of the Boston & Maine, by the T. Stuart & Son Company, contractors, Watertown, Mass. We are indebted for much of the information contained in this article to Beardsley Lawrence, engineer for the contractors, who invented the special details of the bulkhead construction used.

Speeding Up
Special Trackwork Renewal
In a Busy Terminal

Jacksonville Terminal demonstrates feasibility of unusual method by renewing 5 crossings in 6¼ hrs.

As told by W. L. CHOATE
Roadmaster, Jacksonville Terminal Company
Jacksonville, Fla.



The Foundation Completed for Five Crossings, With a Completely Assembled Double Slip Switch Just Beyond It

THE maintenance forces of the Jacksonville Terminal Company recently renewed five railroad crossings in one unit in the busy terminal at Jacksonville, Fla., with a total interruption of train operation of only 6¼ hours. In carrying out this work, the method used was one which was adopted in 1927 after careful study of the most effective means of renewing crossings and slip switches in congested terminals. This method consisted essentially of building up the crossing units complete at a material yard, and then transporting them over the tracks of the terminal on a special set of three trucks, to the site of the installation, where they were lowered into place.

Traffic Makes Crossing Renewal a Problem

Within the Jacksonville terminal area there are 28 double slip switches, 32 crossings and about 300 single split switches, all of which must be maintained and renewed under a traffic of about 125 regular trains a day during the busy seasons, in addition to numerous switching movements. With this track layout, the usual maintenance program calls for the renewal of six double slips, five crossings and a number of single switches each year. In carrying out this work, little unusual difficulty is experienced in renewing single turnout switches under traffic, and this type of work has been done with little interference to regular trains and switching movements. Using the same method, however, the renewal of slip switches and crossings has presented a real problem, and could not be done without occasioning serious delays to train operation and incurring considerable additional expense owing to interruptions and the additional amount of work necessary in making piece-meal installations. To make such renewals under traffic was an unusually difficult task where a revision in foundations was planned, and particularly so in 1927, when a revision was made in the tie spacing and size of plates used in crossing and double slip switch layouts. A combination of these difficulties, together with increasing traffic, led to the adoption of the method now used, which makes it possible to renew single crossings and double slip switches, ready for traffic, in from two to four hours.

Crossings Assembled in a Material Yard

In the present plan of carrying out this class of work, the crossings and double slips are assembled complete in a small material yard, conveniently located in the heart of the terminal. This yard, which merely makes use of available space alongside the express facilities at the terminal, is served by a track from which materials can be loaded and unloaded conveniently without interferring with traffic.

In the recent work, the problem was that of renewing five crossings in the throat of the terminal, these crossings being located on an 8-deg. 4-min. curve, and spaced from 13 ft. to 15 ft. center to center. Based on previous records with these crossings, it would have taken at least 15 hrs. to have renewed them under traffic. Five years ago the crossings were renewed in 11½ hrs., but at that time only a tie foundation was used, and no grading was necessary. In the recent work, a special timber foundation was prepared for the crossings, tying them to-

gether more or less as a unit, which was eight inches lower than the existing foundation. It was expected that considerable difficulty would be encountered in making the necessary excavation for this new foundation under traffic, and, therefore, that it would take considerably longer than 11 hrs. 30 min. to make the renewal with the interference of train operation.

As built up in the material yard, the new foundation for the five crossings consisted of 8-in. by 12-in. cypress timbers extending longitudinally throughout the length of the crossings. This foundation was built upon special blocking of timbers and light weight rails in order to facilitate the construction of the crossings and their movement later to the trucks employed to carry them to the point of installation. The deck of the crossings was made up of 7-in. by 9-in. heart pine ties, and the special trackwork was built up in the usual manner, using 80-lb. material.

Multiple Trucks Transported Assembled Crossings

When the crossings were completely assembled, they were jacked up slightly and then lowered on a series of two-inch steel pipes filled with concrete, over which they were skidded on to a special trucking rig for movement to the site of the installation. The trucking rig, which was made up specially for the purpose, consists essentially of three low trucks, each with four steel flanged wheels and suitable steel axles and cross bracing. Mounted on each of these trucks are three lengths of 80-lb. rail, placed on each side and through the center of the frame to form a carriage. The three trucks are joined together into one unit by two short lengths of rail, acting as couplings, which are bolted to the ends of the center rails of the truck carriages.

As prepared ready to transport the five crossings, a number of crossties were placed transverse of the truck carriages, and on top of them, and at right angles to them, five lengths of two-inch pipe, filled with concrete, were placed to provide a more or less pivotal bearing to facilitate the movement of the loaded trucks around curves. As mounted on the

The Home-Made Trucking Carriage Used to Transport the Assembled Crossings

carriages, the assembled crossings were at a height sufficient to clear all switch stands and other obstacles within that part of the terminal traversed.

No Hoisting Equipment Used

At a selected time, with a period of comparatively light traffic ahead, the assembled crossings were towed to the site of installation by a locomotive crane, and the actual work of renewal was started. During this work, such train movements as were necessary were diverted to other tracks.

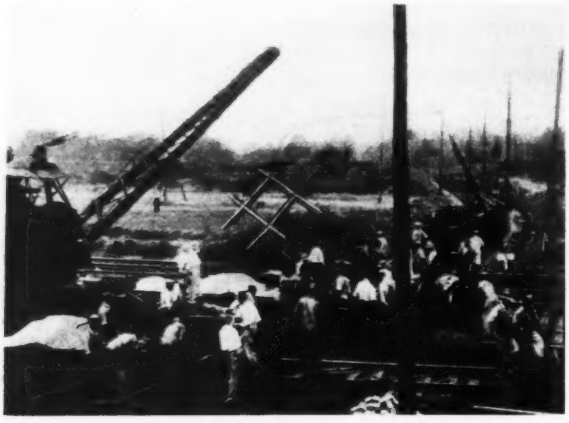
In the first step of the renewal, the old crossings were hurriedly separated by removing the joint plates connecting them, or by burning them apart, after which a locomotive crane picked up the old crossing units and loaded them on a flat car spotted on an adjacent track. Following this operation closely, the old crossing ties were removed and eight

The Five Crossings Completely Assembled in the Material Yard

inches of excavation was made where necessary to provide for the new type of crossing foundation. After this work was completed, a temporary track was laid on the site of the old crossings, using switch bars for gage rods to preclude spiking, and, with the aid of the crane, the assembled new crossings, mounted on the trucking carriage, were pushed out directly over their final location.

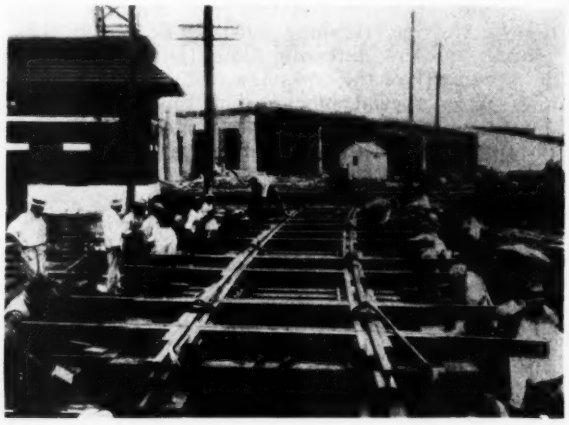
When in position, the crossings were raised free of the carriage by means of track jacks, five being used on each side, and immediately the freed carriage and the temporary track structure on which it rested were withdrawn. After such additional smoothing up of the foundation as was necessary, the entire unit of five crossings was lowered into place by backing off the jacks a notch at a time. When they were finally seated, tamping and bolting-up was done, and just 6 hrs. 15 min. after the tracks were taken over, they were restored to traffic.

If it had not been for a change in the type of timber foundation used under the new crossings, which necessitated considerable excavation work, it is estimated that the entire installation of the new crossings would have been completed, ready for traffic, in 3 hrs. instead of the 6¼ hrs. required. However, in view of the fact that trains were interfered with for 11½ hrs. when the crossings were renewed in 1924, it is felt that the present work was done in a satisfactory manner.



Removing the Old Crossings and Excavating for the New Type of Crossing Foundation

The total cost of the work was $129.06, divided as follows: Assembling the timber foundation, $27.15; constructing the crossings on the foundation, $26.10; removing and loading the old crossings, including the expense of the locomotive crane, $27.81; and excavating and installing the new crossings, $48. The trucking carriage used to move the crossings originally cost $150 to construct, but as this carriage is used in connection with all crossing and slip switch renewals, only a small proportion of its cost is chargeable to an individual job, so that this item is disregarded in figuring the cost of the work.



The New Crossings Being Lowered Into Final Position on Ten Jacks

As already intimated, all double slip switches at the terminal are renewed in much the same manner as that employed in renewing the five crossings, the switches being built up complete in the material yard, transported to the point of installation on the special truck carriage, and then lowered into place. In this work it usually takes 12 men and 1 foreman 16 hours to assemble the switch, at a cost of about $65; 26 men and 1 foreman about 2 hours to lower it into place; and 8 men about 2 hours to couple it up ready for traffic. With the latter two operations costing about $68, the total expense for installing double slip switches by the method used on the Jacksonville terminal amounts to about $133, whereas when these switches were installed under traffic about 20 hours' time was required and the cost was about $170, with much greater interference to train movement.

"The Olympian" of the C. M. St. P. & P., Crossing the Mississippi River Between St. Paul and Minneapolis

Concrete Water Tanks Give Excellent Service

Duluth & Iron Range develops improved design as a result of experience with these structures

By R. A. TANNER
Civil Engineer, St. Paul, Minn.

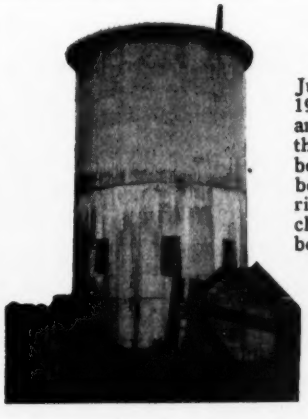
The Concrete Tank at Fairbanks

BETWEEN 1920 and 1923, the Duluth & Iron Range built four elevated concrete tanks and two concrete reservoirs for water supply. As this program of construction was carried out, modifications were made in the design to correct objectionable features encountered in the tanks first built and, while all of the tanks are rendering good service, the later ones embody certain details which, in the opinion of the writer, are resonspible for the continued excellent condition of these tanks in spite of the unfavorable climatic condition to which they are subjected.

The Duluth & Iron Range runs easterly from Duluth, Minn., along the north shore of Lake Superior for 27 miles to Two Harbors and then inland 93 miles to Winton, and westward from Allen Junction to Eveleth and Virginia, with branches to several mines. The road carries a very heavy ore traffic from the mines to Two Harbors during the shipping season, but tonnage in the winter is very light.

This region is known for its heavy snowfall and low temperature, the average temperature at Duluth from November 1 to April 1 being 25 deg. F. with a low temperature of 41 deg. F. below zero, while the inland temperature is still more severe. Abundant supplies of good water are available in the numerous lakes, streams and swamps in this section, but its storage in elevated wood or steel tanks during the severe winters, with but occasional demands, caused considerable trouble and expense due to freezing and leakage.

With the experience gained from each job the construction details were modified, with the result that the more recent structures are unique in design and workmanship. The general design is a cylindrical concrete tower of desired height, supporting a reinforced concrete slab which acts as the bottom of the tank and which, therefore, must be of sufficient strength to carry the water in the tank. Upon this slab rests a circular tank shell of the same diameter as the tower and roofed with concrete. There are no interior supports in either the tower or the tank.



The tank at Tower Junction, erected in 1921, has a 14-in. shell and a bottom 2 ft. thick. The connection between the shell and bottom consists of a ring made of 12-in. channels imbedded in both.

The tank at Biwabik, built in 1920, was designed and constructed in strict compliance with information and ordinary experience in concrete construction available at that time. However, it soon developed leaks, which by 1927 had become so marked that it was necessary to apply complete inside waterproofing, consisting of membrane and asphalt protected by brick veneer, laid in accordance with Johns-Manville specifications. This waterproofing has proved satisfactory and no further trouble with this tank is anticipated.

Modify Design for Second Tank

The tank at Tower Junction, erected in 1921, has a shell 14 in. thick with an outside diameter of 26 ft. 4 in. and a bottom 2 ft. thick, reinforced two ways with ¾-in. rods of variable spacing. These rods are bent vertical at the ends and project about 1½ ft. up through the middle of the tankshell. A ring, made of 12-in. channels spliced together, is embedded 6 in. in the bottom and projects 6 in. up into the center of the shell and serves the purpose of providing reinforcement, bond and seal at the joint, which otherwise would be a plain concrete-to-concrete surface without recess or filler. Unique features of this tank are that the foundation is used for an intake well and the tower houses the power plant for an adjacent coal dock, as well as the pumping machinery.

The tank was tight at the inspection, but stains on the outside indicated previous leaks, which were said to be seasonable and mostly noticeable in the early spring. The outer edge of the bottom showed some spalling and hair cracks were numerous on the tank shell for some distance from the joint. This is to be expected from the secondary stresses to which this type of construction is susceptible. The bottom was tight, the interior of the tower did not indicate any leaks and the tank, as a whole, was in good condition.

The tank at Fairbanks, built in 1922, shows the

effects of additional experience. The rigid concrete-to-concrete joint between bottom and tank shell was replaced by a semi-flexible joint with a soft bituminous filler under part of the shell and between the shell and the projecting shoulder of the bottom. This design was also used in the later structures.

Referring to the sketch, it will be noted that the outside diameter of the tank and tower is 28 ft. 4 in. and the height at the eave is 41 ft. 6 in. The shell is 1 ft. thick throughout, except for a slight increase in thickness at the bottom. The tank has a capacity of 100,000 gal. The ring-formed footing is 2 ft. thick and 5 ft. wide, reinforced with three hoops and ½-in. by 5-ft. transverse rods at 6-in. centers. The foundation ring is 1 ft. thick by 5 ft. high with five reinforcing hoops. A 5-in. plain concrete floor is laid flush with the top of the foundation and a small valve and drain sump are provided near the wall.

The tower shell, reinforced by seven hoops, is cast integral with the tank bottom and is provided with a double door 5 ft. 4 in. by 7 ft. and with five windows, each with four 12-in. by 24-in. lights. The tank bottom is 2 ft. 2 in. thick with an annular shoulder of 2 in. inside the tank shell, is recessed 4 in. under the shell and has a 4-in. by 12-in. projection outside the shell, shaped as a drip cap. It is reinforced by 100 rods, ¾ in. by 33 ft., arranged in four groups at 45 deg. to each other and curved at the ends to project about 2½ ft. into the tank shell near the inner surface. The ring has been reduced to an 8-in. channel imbedded 4 in. into the bottom.

Provide Bitumen Joint

The tank is 24 ft. 10 in. high, inside, reinforced by 59 hoops supported on 12 angles, 2½-in. by 2½-in. by ¼-in., and ¾-in. vertical rods at 6-in. centers, all placed near the outer third of the shell. All hoops are ¾-in. rods 32 ft. long, with three rods to the hoop. The lower part of the shell is increased 6 in. in thickness on the inside by a bevel fillet about 2 ft. 6 in. high and has a 4-in. by 12-in. projection on the outside. The contact surface between shell and bottom is, therefore, 22 in. wide, of which 14 in. is inside the ring. This 14 in. is covered by soft bitumen upon which the tank shell is poured in one continuous operation. An annular groove ¾ in. wide by 4 in. deep is left between the shell and the shoulder of the bottom, into which tar is poured to complete the seal.

The concrete roof projects 9 in. outside the shell and is 6 in. thick at the edge and 10 in. at the center, reinforced by 84 rods ½ in. by 29 ft. in four groups at 45 deg. The 2-ft. by 4-ft. 6-in. hatchway is covered by three concrete slabs with rings for handling.

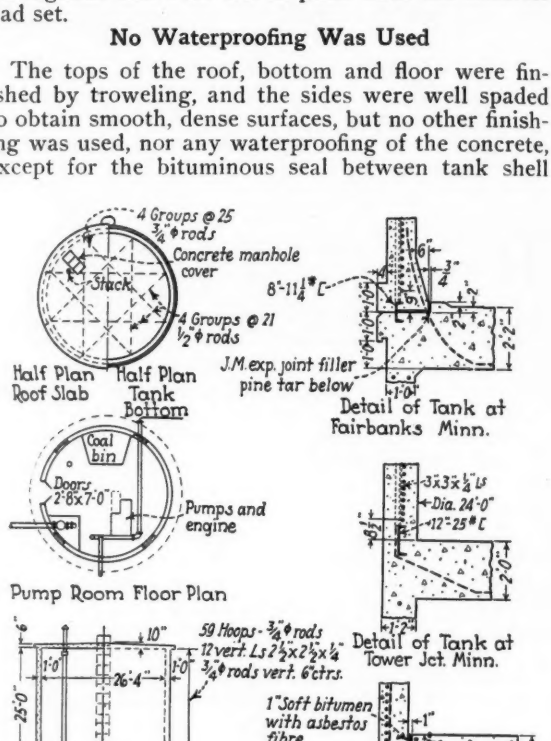
The Tank at Robinson Is Equipped With a Spout

A vertical iron ladder with guard extends from about 10 ft. above the ground to the roof. An 8-in. inlet pipe and a 10-in. outlet pipe are cast into the tank bottom and an 8-in. smoke pipe projects through the roof. These pipes are of cast iron and no provision is made for expansion except for such flexibility as the elbows and other fittings may provide.

The concrete is a 1:2:4 mixture with just enough water to make it workable under the various conditions. Steel forms for the cylindrical shell were used throughout and were left in place until the concrete had set.

No Waterproofing Was Used

The tops of the roof, bottom and floor were finished by troweling, and the sides were well spaded to obtain smooth, dense surfaces, but no other finishing was used, nor any waterproofing of the concrete, except for the bituminous seal between tank shell



Typical Details of the Tank at Fairbanks

and bottom. The tank required 250 cu. yd. of concrete, 25,000 lb. of reinforcing rods, 2,700 lb. of structural steel, five windows, one double door and one coal bin. This material was furnished by the railroad at a cost of $2,300. The construction was done by contractors, who used their standard steel forms at a cost of $3,587.29. The total cost was, therefore, $5,887.29, exclusive of piping, engineering and freight.

The space under the tank provides room for a coal bin, a hot-air furnace ($248.76 in place), the old 15 hp. Fairbanks-Morse pump, and the various control valves.

At the inspection, the concrete was found in perfect condition without any cracks, spalling or pitting, either outside the tank or on the 6 ft. exposed above the water level on the inside. A small leak had developed in the joint between the bottom and the tank on the south side, causing some water and tar to flow out and discolor the concrete, as is clearly

noticeable in the illustration. This leak closed up shortly afterwards and at the end of the rush season the tank was emptied and additional tar poured into the annular ring. No other sign of leakage could be found, either outside or inside the tower, or along the pipes projecting through the bottom.

The tower provides an excellent operating and pump room, dry, warm and light, marred only by the smoke stains produced by the oil engine and occasionally by the banked fire. About 12 tons of coal are used annually for heating and no trouble has been experienced from freezing.

The tank at Robinson, built in 1922, is similar to the Fairbanks tank, although smaller and having a spout discharge. Owing to a mishap, it was necessary to permit a construction joint 4 to 5 ft. below the top of the tank, but so far no leak has developed and the tank is perfectly tight.

Another interesting feature of this tank is the absence of any valve-operating levers or rods inside the tank, which eliminates the possibilities of interference from ice or rime. This is done by placing a water-column valve on the discharge line in the tower just below the bottom and operating it from below by a horizontal rod with a hinged extension along the spout. This arrangement has been entirely satisfactory . The reservoirs at Ely and Highland, although without towers are similar to the Fairbanks tank and have been entirely satisfactory.

Some Considerations of Design

The unique designs developed to overcome the troubles encountered in the first tanks on the D. & I. R. point toward a new conception of concrete tank construction, and the analysis of these designs is, therefore, of interest.

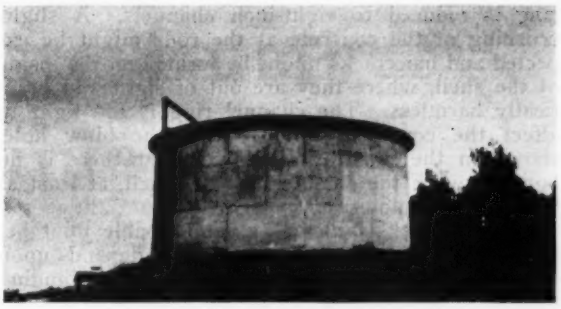
The tower is subjected to straight compressive loading from the tub and the water, and bending moments from the wind load. Owing to the weight and size of the structure, the bending moments are too small to produce tension and the tower is, therefore, reinforced only for tension caused by expansion.

The bottom slab, cast integral with the tower, is designed on the principle of a plate supported around its rim, using the formula $M=1/6\ mwr^2$, in which M is the maximum moment, w is load per unit of area, r is the radius of the slab inside the supporting rim and m the material coefficient, taken as 1.0 for reinforced concrete. Applying this formula to the tank at Fairbanks, the maximum moment at the center of the slab is:

$$M=1{,}850\times13\ 1/6\times13\ 1/6\times1/6$$

This equals 53,450 ft. lb. per 1 ft. of width, producing about 9,300 lb. tension in the reinforcing steel and about 500 lb. per sq. in. compression in the concrete. As the slab is cast integral with the tower and is held down by the tub shell, it is fixed and the moment and fiber stresses will be two-thirds of that given. This construction will produce a negative moment near the rim of the slab for which it has no reinforcement. As no leaks could be found at this circle, it is evident that the small negative moment is of no practical importance with the heavy slab used, but should be considered, of course, if the slab was designed for the smaller moment of a fixed slab.

The tub shell, when considered independent of the bottom, sustains an internal pressure increasing from zero to a maximum with the depth of the water. For a tub 25 ft. deep, containing 24.5 ft. of water, the fiber stresses in the hoops will be zero at the top and about 11,400 lb. per sq. in. at the bottom. This stress



The Reservoir at Ely

is produced by radial forces having no vertical components.

The contact surface between the shell and the slab supports the vertical load of the shell and roof, with such slight modifications as are produced by the wind. This vertical load is equal to 18.3 lb. per sq. in. The water pressure at the bottom, with a full tub, is 10.6 lb. per sq. in., and the wind pressure about 1 lb. per sq. in. Therefore, the stability of the shell is 158 per cent of the tendency of the water and wind to lift it up, providing the full hydrostatic pressure of the water could be exerted under the shell. It will be noted that if the base of the shell was only 12 in. thick, the stability could be about 270 per cent. It is, therefore, evident that the bond necessary between the shell and the bottom is to prevent leakage only.

Radial Forces Are Severe

Referring back to the radial forces and assuming that the steel hoops take up all the tension, it will be found that a fiber stress of 11,400 lb. per sq. in. is produced by a radial elongation of 0.06 in.; that is, while the diameter at the top of the shell will be constant, the bottom diameter will be 0.12 in. larger with a full tank than with an empty one, exclusive of temperature changes. Simultaneously with the increase in the diameter of the shell comes a decrease in the diameter of the upper fibers of the bottom, due to the deflection of the latter. For a bottom cast integral with the tower, so as to form a cantilevered plate, this decrease in diameter is too minute to be of practical value. It is mentioned here merely to show the tendency. A temperature difference of 10 deg. F. between the bottom and the shell will cause a variation of about 0.024 in. in the diameter, and may add to or subtract from the variations cited above. However, such temperature differences, as well as the effect of the expansion of ice inside of the shell, are very uncertain and need not be considered for the purpose of this discussion.

The outstanding fact is that there is a continuous tendency for a sliding motion between the shell and the bottom slab, which either must be arrested by ample means, or permitted to act freely. In the tank at Tower Junction, bond is provided between the shell and bottom by means of vertical rods and a ring, made of 12-in. channels, intended also to form a seal. This method of arresting the sliding tendency proved inadequate and spalling of the outer edges of the bottom and haircracks in the lower part of the shell resulted, indicating heavy outward forces in the former and weaving actions in the latter.

In the Fairbanks tank the shell thickness is increased at the base, the bottom reinforcing bars are curved upward near the inside of the shell and the

ring is reduced to eight-inch channels. A slight crushing of the concrete at the rods might be expected and haircracks might be formed on the inside of the shell, where they are out of sight and practically harmless. The channel ring is too light to affect the concrete seriously and the blow hole, shown in the illustration, proves that there is no bond between the channel and the shell, at least at this particular point.

The Fairbanks tank has a semi-flexible joint between the shell and the bottom, which depends upon the bitumen filler for sealing, and has the binding members so distributed as to cause no serious damage to the concrete. In fact, the effect of the bonds is evidently negligible, both as to strength and seal, after the tank has been in use for some time.

This evolution from the customary design, with a rigid joint, is very interesting and encouraging. The customary design of curving the bottom along the shell so as to form a heavy joint, strongly reinforced, has proved that the joint will hold, but that the secondary stresses produced by this effort to check the elongation and contraction cause destruction outside of the joint. Our effort to work against nature has as usual proved our own shortcomings in logical and consistent reasoning. From the results obtained by the usual designs, as well as the experience of the D. & I. R., it seems proper to permit the opposing movements of the shell and bottom to expend themselves freely and depend upon a flexible seal to prevent leakage.

How to Get a Good Joint

The recessed rim of the bottom is troweled smooth and coated with heavy asphalt to form a sliding surface. Reinforcing hoops are placed near the joint to prevent haircracks, caused by friction stresses, and the outer edge of the bottom is beveled off to prevent spalling. The eight-inch shoulder forms an annular groove one inch wide inside the shell, which is filled with mastic upon completion. This is the most important part of the water seal and requires care both in the selection of material and in its application. The bitumen should have a specific gravity of not less than 1.1, should remain plastic under the lowest temperature that might be expected and should not become too soft under summer heat. An admixture of asbestos fibers might be advisable. To insure bond between the concrete and the mastic filler, the concrete surfaces should be clean and a coating of emulsified asphalt may be beneficial. The experience with the Fairbanks tank, with only a four-inch shoulder, proves however that a satisfactory seal may be obtained with even less stringent specifications.

The estimated cost of a 100,000-gal. tank on a 30-ft. tower is $6,300, exclusive of piping, freight and overhead expense. The tower will provide 540 sq. ft. of excellent floor space for pumping machinery, a water treating plant or for other purposes. Based upon 40 years life, the annual cost including annuities, will be $416.

A 100,000-gal. redwood tank on a 30-ft. frame tower, with frost casing and a foundation such as is usually built in the northern states, will cost about $5,170, and the annual cost will be $506. If combined with a treating plant having a floor area of 350 sq. ft., with an enclosed stairway to the top of the tank, the capital expenditure will be $6,970, and the annual cost $676, based upon 20 years life for the tub and building, 10 years for the tower and frost casing and 40 years for the foundation.

These structures were designed and built under the supervision of W. A. Clark, chief engineer, and Leland Clapper, engineer of bridges and buildings of the D. & I. R., and the writer is indebted to these two officers for plans and data regarding the structures, and also for the opportunity to make personal inspection of the tanks at Fairbanks, Tower Junction and Robinson, and the standpipe at Ely.

Treated Wood in Sash Construction

THE USE of wood sash in skylights of enginehouses has been standard practice on many roads for years, although the action of the weather and of the moisture in the house exerts a marked effect in shortening the life of untreated wood. For this reason, the Lehigh Valley, in renewing the sash in the skylight of an enginehouse at Cortland, N. Y., about eight years ago, used treated yellow pine, sawed from creosoted pile butts, as an experiment.

The original sash in this skylight were of untreated white pine and consisted of two panes, 20 in. by 48 in. In renewing these sash, the construction was altered to provide nine panes, 12 in. by 14 in., and the size of the muntins was increased to two inches to enable them better to withstand the strain imposed by severe windstorms common to this vicinity; also the tops of the cross muntins were beveled to prevent the collection and retention of water. Instead of using putty to hold and seal the panes in place, small strips of ⅜-in. by ½-in. timber were fastened to the muntins by small brads. After eight years' service, these sash are apparently as firm and solid as the day they were placed in service.

The value of the increase in size of the muntins was shown about two years ago when one of the skylights was dislodged by a strong wind. The more recently constructed sash remained intact, without even the glass being broken, while the original sash with the smaller and fewer muntins were badly damaged.

About seven years ago, the sash in the windows and walls of the enginehouse at Auburn, N. Y., were renewed with creosoted timber and constructed to conform to the prevailing standard of sash design. These sash have 16 panes, 10 in. by 14 in., there being two sash and therefore 32 panes to the window. Again, as at Cortland, no putty was used, the ⅜-in. by ½-in. strips being held in place by three small brads. These sash are likewise in excellent condition.

We are indebted for this information to J. P. Hofecker, supervisor of bridges and buildings on the Lehigh Valley at Auburn, N. Y.

Under Crossing of State Highway No. 46, Missouri-Kansas-Texas, New Braunfels, Tex.

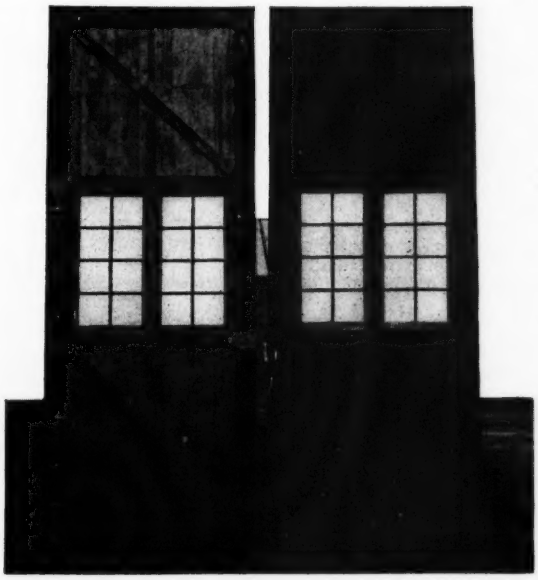
Making Waste Lumber Pay Dividends

Salvaged material and short-length stock are used in doors, boxes, gates, snow fences and ready-made buildings in Burlington shop at Havelock

A Factory-Built Standard Section Tool House

THE self-evident truth of the old saying that the cost of maintenance could be reduced if the work could be brought to the shop instead of sending the gang to the work is being demonstrated practically by the Chicago, Burlington & Quincy, which, by the use of waste lumber for the construction of ready-built structures and accessories, such as section tool houses, enginehouse doors and telephone booths, is effecting large savings in both the cost of materials and in the labor of erecting them. These are built to standard plans in a carpenter shop operated by the stores department at Havelock, Neb., near Lincoln. This shop, which was established three years ago, is equipped with machinery and power-operated hand tools to work up old lumber and timber salvaged from dismantled cars, bridges and buildings, and is effecting a saving amounting to over $10,000 annually.

Havelock is the location of the principal car repair shops of the Burlington's lines west of the Missouri river; the main storehouse for that portion of the system is also located here. At this point several hundred old freight cars are torn down every year, furnishing a steady supply of second-hand lumber in the form of sills, posts, braces, doors and siding. A further source of supply is found in lumber and timber salvaged from wooden buildings and trestles which have been replaced with more permanent structures, 2,000,000 ft. b. m. of this material having been released from these structures within the last few years.



Enginehouse Doors Built from Salvaged Lumber

First Step Was to Salvage Lumber

The first steps in establishing the reclamation plant for second-hand lumber were taken several years ago, when the Burlington decided that it would be worth while to recondition this material by removing the old nails and sawing off the damaged sides and edges. The work was placed in charge of the stores department, which set up a frame shop equipped with a large circular saw for cutting up heavy timbers and a cut-off saw. During its early operation, this mill produced large quantities of well-seasoned lumber which could be used for a variety of purposes, but it also produced many odd lengths which were too good to burn, yet which were of small value unless they could be worked up into articles at the point where they were produced. Similar odd lengths were available from two other sources at Havelock. One of these was the car-repair tracks where odd lengths of new lumber accumulated and the other was the mill where rough lumber from the Black Hills was finished and cut to standard lengths.

In 1925, the Burlington established a mill at Havelock to condition this lumber, which it agreed to take in its rough form in order to encourage the production of ties in the Black Hills of South Dakota, which constitute the only large area of standing timber suitable for ties on its system of more than 9,000 miles. In an effort to utilize this source of supply, it was found that tie producers could not operate at a satisfactory profit unless a market was provided for the lumber which was produced with the ties, but which could not compete in the general markets with the standard grades of lumber. In order to furnish an outlet for this lumber, which is suit-

able for various railway purposes, the railway agreed to purchase quantities of it in the rough. The lumber is produced by primitive methods and comes to the mill at Havelock in a variety of lengths and thicknesses, resulting in end pieces and edgings which can be used for articles not requiring the longer pieces. The mill was equipped with an automatic cut-off saw, a rip saw, a large planer, a sticker and a portable cut-off saw.

Manufacture of Assembled Articles Begun

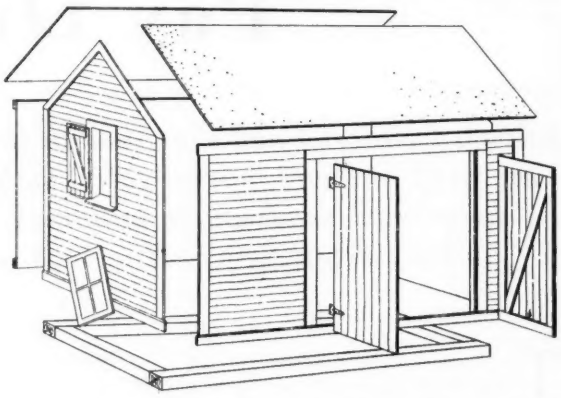
With a large supply of second-hand lumber as well as a plentiful amount of odd lengths of new lumber on hand, it was realized that further savings could be made by working up the material into finished articles at Havelock and a start in this direction was made by the assembling of boxes and shipping cases, for the stores department and other departments of the road. After this plan was put into operation, it was seen that still further economies could be effected by performing at Havelock much of the carpentry work which had formerly been done by the division forces.

On maintenance work, in the construction of new buildings of small size, it had been the custom to ship standard lengths of lumber to the site of the building, where the material was framed by hand for the individual job, resulting in the waste of the short ends. With the limited scope of the division activities, there was no immediate use for these short lengths, while their collection, shipment and storage would entail costs which would offset any possible

The Reclaiming Mill at Havelock

saving by so doing. By making a variety of articles at Havelock which would permit the utilization of these short pieces, savings were made both in the use of lumber and the cost of assembling it in the completed structure. For buildings too large to be shipped in the completed form, the component parts are made in sections designed to be erected by bolting them together, which can be done without the use of skilled labor, since the sections are fitted, bored and marked before being shipped.

The carpenter shop, which, like the resaw mill for reclaiming second-hand timber, and the mill for conditioning the Black Hills lumber, is of simple frame construction, is equipped with power hand tools for systematic and efficient work, these comprising two electric cut-off and rip saws, one 1¼ in. electric hand saw and three electric drills. The work is under the direction of an experienced carpenter and is done according to standard plans for each article produced, these plans being drawn to allow the use



Roadway Tool Houses and Similar Buildings Are Erected By Bolting Together Standard Built-Up Sections Which Are Shipped from the Mill

of short ends as far as possible, and listing every piece of wood, as well as the hardware to be used in the article.

The annual output of the carpenter shop at the present rate of consumption, together with the savings in cost, are shown in the appended table, from which it will be noted that the most of the articles manufactured are those which the building department is usually called on to furnish.

Output of Carpenter Shop

Description	Number per year	Unit saving	Total saving
Garages	25	$34.00	$ 850
Toilets for laborers	20	15.00	300
Section tool houses	50	33.00	165
Hose houses	20	10.00	200
Hose cart houses	20	12.00	240
Roundhouse doors	100 pr.	85.00	8,500
Merchandise loading gates, 4 ft.	1,100	.09	99
Merchandise loading gates, 8 ft.	1,500	.13	195
Telephone booths	50	.95	47
Engine ice-boxes	400	.40	160
Stockyard gates	75	5.00	375
Stock chute gates	75	2.50	188
Blocking for explosives, 4 ft.	1,100	.07	77
Blocking for explosives, 8 ft.	1,000	.09	90
Stock car gates	100	.45	45
Storehouse racks	500 lin. ft.	.60	300
A-frames for cattle guards	100	1.30	130
Automobile unloading platforms	5	38.40	192
Water coolers, 5-gal.	100	1.65	165
Shipping boxes for oil cans	25	.90	22
Shipping boxes for fusees	100	.50	50
Shipping boxes for torpedoes	100	.42	42
Tool boxes for extra gangs	25	2.85	71
Push-car dump boxes	100	2.25	225
			$12,728

An account is kept of the cost of all material and labor, plus a fixed overhead charge for each job and this is compared with the estimated cost of the building or article under the former methods. These comparisons show that the carpenter shop has effected savings of from 25 to 35 per cent in many instances, while in some cases the reduction in cost is much greater.

The plant is operated under the general direction of J. G. Stuart, general storekeeper, using plans drawn by the building department for all buildings or building accessories.

Fewer Ties Treated in 1928

Statistics prepared by Forest Service also show reduction in total volume of wood treated, although use of preservatives increased

IN 1928, 70,114,405 crossties were given preservative treatment in the United States. This is less by 4,117,435 than the number of ties treated in 1927. However, in spite of this reduction, as compared with the output of 74,231,840 ties in 1927, the number of ties treated in 1928 was greater than that of any other year except 1927. These and other figures given here were taken from the statistics on wood preservation prepared by R. K. Helphenstine, Jr., forest service, United States Department of Agriculture, in co-operation with the American Wood-Preservers' Association.

Expressed in terms of the volume of wood, the treatment of ties in 1928, totaled 210,343,215 cu. ft. or 62.7 per cent of the volume of wood treated for all purposes last year, namely, 335,920,379 cu. ft. In 1927, the treatment of ties represented 222,695,520 cu. ft. or 64.5 per cent of the total, which was 345,685,804 cu. ft. This reduction in the total is due largely to the reduction in the treatment of ties, since there were appreciable increases in the treatment of piles, poles, and construction timbers. Decreases occurred in the treatment of switch ties, wood blocks and miscellaneous materials, as shown in the table below.

Statement of Material Treated by Classes (Cu. Ft.)

	1928	1927	Decrease
Crossties	210,343,215	222,695,520	12,352,305
Switch ties	14,533,450	15,200,934	667,484
Piles	13,665,394	11,660,322	2,005,072*
Poles	64,325,976	64,028,607	297,369*
Wood blocks	3,676,312	5,271,420	1,595,108
Crossarms	1,207,512	1,008,192	199,320*
Construction timbers	20,157,747	17,344,062	2,813,685*
Miscellaneous materials	8,010,773	8,476,747	465,974
Total	335,920,379	345,685,804	9,765,425

*Increase

However, in spite of a decrease of 2.8 per cent in the volume of wood treated, there was an increase in the consumption of all of the major preservatives, the total for creosote, 220,478,409 gal., being the record for the industry in this country. Zinc chloride showed an increase for the first time in five years, the total being 23,524,340 lb. as compared with 22,162,718 lb. in 1927. The consumption of petroleum increased from 22,911,134 gal. in 1927 to 25,073,903 gal. in 1928, and the use of paving oil from 1,389,465 gal. to 2,347,518 gal. Miscellaneous salts used for preserving wood are shown separately under "miscellaneous preservatives" for the first time. The use of such salts, including mercuric chloride zinc meta-arsenite, sodium arsenite, Wolman salts and sodium fluoride, amounted to 443,308 lb., while the consumption of liquid preservatives, such as cresoil, ac-zol and carbosota totaled 417,953 gal. The statistics also show a further reduction in the use of imported creosote, which totaled 82,154,731 gal. in 1928, compared with 91,061,509 gal. in 1927.

During 1928, 10 new treating plants were constructed, of which 3 were placed in operation during the year. Three plants, all of which were commercial non-pressure plants, were abandoned. The total number of plants in existence during 1928 was 207, of which 193 were in active operation and 14 were idle. Of the total, 142 were commercial plants, 34 were owned and operated by railroads and 31 were privately owned or public utility plants.

Wood Preservation, 1909-1928

Together with consumption of creosote and zinc chloride

Year	Total Material Treated, Cu. Ft.	Number of Crossties Treated	Creosote Used, Gal.	Zinc Chloride Used, Lb.
1909	75,946,419	20,693,012	51,426,212	16,215,107
1910	100,074,144	26,155,677	63,266,271	16,802,532
1911	111,524,563	28,394,140	73,027,335	16,359,797
1912	125,931,056	32,394,336	83,666,490	20,751,711
1913	153,613,888	40,260,416	108,378,359	26,466,803
1914	159,582,639	43,846,987	79,334,606	27,212,259
1915	140,858,963	37,085,585	80,859,442	33,269,604
1916	150,522,982	37,469,368	90,404,749	26,746,577
1917	137,338,586	33,459,470	75,541,737	26,444,689
1918	122,612,890	30,609,209	52,776,386	31,101,111
1919	146,060,994	37,567,247	65,556,247	43,483,134
1920	173,309,505	44,987,532	68,757,508	49,717,929
1921	201,643,228	55,383,515	76,513,279	51,375,360
1922	166,620,347	41,316,474	86,321,389	29,868,639
1923	224,375,468	53,610,175	127,417,305	28,830,817
1924	268,583,235	62,632,710	157,305,358	33,208,675
1925	274,474,538	62,563,911	167,642,790	26,378,658
1926	289,322,079	62,654,538	185,733,180	24,777,020
1927	345,685,804	74,231,840	219,778,430	22,162,718
1928	335,920,379	70,114,405	220,478,409	23,524,340

As was the case in 1927, oak, yellow pine and Douglas fir ties ranked first, second and third respectively in 1928 from the standpoint of quantity treated. Of the first mentioned, 27,662,960, or considerably more than a third of the total, were subjected to

Crossties Treated by—Kinds of Wood and Kinds of Preservatives—1928

Kind of wood	Number of Crossties Treated with creosote (1)	Treated with creosote-petroleum (2)	Treated with zinc-creosote (3)	Treated with zinc chloride	Treated with miscellaneous preservatives	Total	Per cent of total
Oak	22,220,445	2,476,861	929,245	2,024,908	11,501	27,662,960	39.5
Yellow pine	8,913,576	4,105,771	49,292	345,389	3,500	13,417,528	19.1
Douglas fir	39,431	6,220,899	.....	1,280,930	40,000	7,581,260	10.8
Gum	3,703,629	669,137	466,909	425,208	.....	5,264,883	7.5
Beech	1,403,272	479,195	185,372	834,427	.....	2,902,266	4.1
Maple	1,236,454	651,053	185,372	787,626	.....	2,860,505	4.1
Lodgepole pine	208,715	543,096	380,046	1,396,567	.....	2,528,424	3.6
Birch	537,001	847,978	92,686	706,013	.....	2,183,678	3.1
Western yellow pine	.....	646,527	394,774	488,027	.....	1,529,328	2.2
Tamarack	75,389	621,707	.....	749,588	.....	1,446,684	2.1
Hemlock	6,752	222,234	.....	1,096,988	.....	1,325,974	1.9
Elm	17,212	51,006	92,686	48,403	.....	209,307	.3
All other	617,442	183,715	92,689	307,762	.....	1,201,608	1.7
Total	38,979,318	17,719,179	(4) 2,869,071	10,491,836	55,001	70,114,405	100.0
Per cent of total	55.6	25.2	4.1	15.0	0.1	.....	.....

(1) Includes distillate coal-tar creosote, creosote coal-tar solution, refined water-gas tar and water-gas tar solution.
(2) Includes distillate coal-tar creosote, creosote coal-tar solution, refined water-gas tar and water-gas tar solution, in mixture with petroleum.
(3) Includes distillate coal-tar creosote, creosote coal-tar solution, refined water-gas tar and water-gas tar solution, in mixture with zinc chloride.
(4) Includes 320,046 ties treated with mixture of zinc chloride and petroleum.

Preservatives Used and Material Treated in the United States, 1927-1928

Number of Plants in Operation, Preservatives Used, and Material Treated		1927	1928
Number of plants in active operation		187	193
Preservatives used			
Creosote			
Domestic [1]	(Gallons)	128,716,921	138,323,678
Imported	(Gallons)	91,061,509	82,154,731
Total	(Gallons)	219,778,430	220,478,409
Petroleum	(Gallons)	22,911,134	25,075,903
Paving oil	(Gallons)	1,389,465	2,347,518
Zinc chloride	(Pounds)	22,162,718	23,524,340
Misc. preservatives [2]		631,234	.....
Salts	(Pounds)	.....	443,308
Liquids	(Gallons)	.....	417,953
Material Treated			
Crossties			
Hewed	(Number)	45,177,218	38,323,854
Sawed	(Number)	29,054,622	31,790,551
Total	(Number)	74,231,840	70,114,405
Switch ties	(Bd. Ft.)	182,411,211	174,401,401
Piles	(Lin. Ft.)	17,241,345	20,206,112
Poles	(Number)	3,637,989	3,654,885
Wood blocks	(Sq. Yds.)	2,008,160	1,400,500
Const. timbers	(Bd. Ft.)	390,539,947	241,892,969
Cross arms	(Number)	1,626,641	1,948,228
Miscellaneous	(Bd. Ft.)	101,720,964	96,129,282

(1) Includes distillate coal-tar creosote, creosote coal-tar solution, refined water-gas tar, and water-gas tar solution.
(2) Shown previous to 1928 as gallons of miscellaneous treating solutions.

treatment. The number of yellow pine ties reported was 13,417,528, while those of Douglas fir amounted to 7,581,260.

Of the 70,114,405 crossties reported by the wood-preserving industry in 1928, a total of 38,979,318 or 55.6 per cent were treated with creosote. The number of ties that were subjected to treatment with this preservative in mixture with petroleum during that year was 17,719,179 or 25.2 per cent. Zinc chloride was used in the treatment of 10,491,836 crossties, while 2,869,071 were treated with zinc chloride in mixture with creosote. In addition to the crossties mentioned above that were given treatment with the preservatives indicated, 55,001 ties were subjected to treatment with miscellaneous preservatives. Particulars concerning these and other woods treated are given in a table.

Treatment of Miscellaneous Materials ft. b. m.

	1928	1927	1926
Lumber	64,426,979	53,567,458	12,255,609
Fence posts	7,272,422	23,439,193	6,742,132
Tie plugs	1,747,026	2,045,765	2,664,459
Car material	542,024	1,778,928	2,954,088
Crossing plank	1,460,463	419,541	286,008

The table of selected items taken from tabulation of miscellaneous materials shows a wide variation in the amounts treated in the years 1926, 1927 and 1928. Compared with 1928, there were increases in 1928 in the treatment of lumber and crossing plank, but reductions in the case of tie plugs and car material and especially in the case of fence posts.

Pennsylvania Makes Event of Annual Inspection

FOLLOWING periodic inspections throughout the year, and annual track inspections recently completed on all three regions and the New York zone of the Pennsylvania, a large number of supervisors and assistant supervisors were awarded substantial cash prizes for excellence in the condition of their tracks.

A feature of the annual inspections this year was the use of a new type of specially constructed inspection cars, one at the head end and another at the rear end of each of the special inspection trains. These cars, which are converted passenger coaches, are divided into two main parts, one half being lined on both sides with benches and lockers, while the other half is equipped with tiers of seats, stepped up so as to give everyone an unobstructed view of the tracks. A folding glass door, which is normally folded back flat against the ceiling of the car, is provided to enable the rear end of the car to be enclosed in inclement weather. Another feature of the cars is a small compartment in the top of each car, provided to enable a trainman to look over his train in the performance of his duties, without interfering with the inspection party. This space, which is normally covered with a trap door, is reached by a narrow stairway and has a single seat for the trainman.

Results on Eastern Region

The general manager's annual track inspection on the Eastern region extended over two days, and the general manager's party, which included a large number of supervisors, assistant supervisors, division engineers, superintendents and general superintendents, rode over the main lines of the Eastern region in two special trains. The principal prize, which is known as the "Klondike" prize, and which is awarded to the main line supervisor's territory between New York and Altoona, Pa., and Philadelphia, Pa., and Washington, D. C., which has maintained the best line and surface throughout the year, was won by Sub-Division 4 of the New York division, of which F. P. Filippelli, at Trenton, N. J., is supervisor, and W. L. Steltzer, assistant supervisor. This prize amounted to $1,200, of which Mr. Filippelli received $800 and Mr. Steltzer $400.

The prize for the greatest improvement made in track conditions during the year between the same main-line points mentioned above, which amounted to $1,000, was awarded to R. H. Joyce, supervisor, and A. H. Stimson, assistant supervisor, of Sub-Division 31 of the Philadelphia division, at Downingtown, Pa. In the division of this prize, Mr. Joyce received $700 and Mr. Stimson $300.

Three additional prizes of $800 each were awarded to the supervisors and assistant supervisors maintaining the best line and surface on the three general divisions comprising the main line between New York and Altoona, and Philadelphia and Washington, excluding the winners of the "Klondike" prize. These prizes, which included $600 for the supervisor and $200 for the assistant supervisor, were awarded as follows:

J. S. Gillum, supervisor, and G. M. Hain, assistant supervisor, Sub-Division 32 of the Philadelphia division, at Lancaster, Pa.; E. L. Hunter, supervisor,

and J. T. Honker, assistant supervisor, Sub-Division 44 of the Middle division, at Huntingdon, Pa.; and W. T. Bevan, supervisor, and L. B. Curtis, assistant supervisor, Sub-Division 83 of the Maryland division, at Perryville, Md.

New York Zone

Following methods of inspection similar to those used on the main regions of the road, a considerable number of prize awards were also made on the New York zone, which includes the Long Island. Announcement of the prize winners on the New York and New Jersey divisions of the zone have not been made public as yet, and therefore, the following has reference only to the awards made on the Long Island.

P. C. Smedley, supervisor of Sub-Division 2, with headquarters at Jamaica, N. Y., received the so-called "Klondike" prize of $200 for having maintained his tracks in the best condition throughout the year. The second highest prize of $100 was awarded to F. J. Nehrhoff, supervisor of Sub-Division 4, at Patchogue, N. Y. The "improvement" prize of $100, awarded to the supervisor showing the greatest improvement in his tracks for the year, was awarded to H. W. Manning, at Hicksville, N. Y.

In addition to the prizes awarded to supervisors, first and second prizes of $100 and $50, respectively, were awarded to track foremen on the five sub-divisions.

On the Central Region

Seventeen main-line and branch-line supervisors were awarded cash prizes on the Central region of the Pennsylvania as a result of the annual inspection and periodic inspections made on that region. The largest prize award, which amounts to $800, and which is given for the best maintained line and surface on the main line tracks of the region, was made to C. H. Frick, supervisor on Sub-Division 11 of the Pittsburgh division, at Derry, Pa., and carried with it a prize of $400, which was awarded to T. F. Angus, assistant supervisor on the same division. For the best line and surface on the other main-line divisions, cash prizes of $600 were awarded to H. R. Rockenbach, supervisor on Sub-Division 3 of the Eastern division, with headquarters at Rochester, Pa., and to J. C. Dayton, supervisor on Sub-Division 5 of the Panhandle division, at New Comerstown, Ohio, and an award of $200 was made to J. C. Buzard, assistant supervisor on Sub-Division 5 of the Panhandle division, at New Comerstown.

First and second prizes, amounting to $700 and $300 respectively, were made to the main line Sub-Division which showed the greatest physical improvement during the year. These prizes were won by Sub-Division 4 of the Eastern division, of which R. G. Davis, at Alliance, Ohio, is supervisor, and E. R. Shultz, assistant supervisor.

Ten other prizes, of $100 each, were awarded to branch-line supervisors on the Central region for excellence in track conditions. These were won by the following supervisors: C. B. Bush, Sub-Division 33 of the Pittsburgh division, at South Fork, Pa.; W. P. Critchfield, Sub-Division 18 of the Conemaugh division, at Blairsville, Pa.; O. L. Fisher, Sub-Division 14 of the Monongahela division, at Youngwood, Pa.; W. W. Boyer, Sub-Division 3 of the Cleveland division, at Ravenna, Ohio; G. A. Sawyer, Sub-Division 2 of the Erie and Ashtabula division, at Sharon, Pa.; M. J. Bray, Sub-Division 2 of the Akron division, at Orrville, Ohio; J. C. Groft, Sub-Division B of the Wheeling division, at Steubenville, Ohio; L. C. Martoia, Sub-Division 2 of the Allegheny division, at Kittanning, Pa.; J. S. Considine, Sub-Division 7 of the Buffalo division, at Buffalo, N. Y.; I. S. Pringle, Sub-Division 8 of the Renova division, with headquarters at Emporium, Pa.

Western Region Awards

Following the annual inspection of the Western region by the general manager cash prizes totaling $3,300 were awarded on November 2, for the best track on the main lines. The Klondike prize of $800 was awarded to Allen F. Roper, supervisor on the Cincinnati-Columbus main line, at Morrow, Ohio, while the $700 improvement prize went to Jasper N. Sagester, supervisor of Sub-Division 2 of the Columbus division, at Urbana, Ohio. Prizes of $600 were awarded Barney J. Boyle, supervisor of Sub-Division 2 on the St. Louis division at Terre Haute, Ind., Delphi Lewis, a supervisor of Sub-Division 4 of the Columbus division, at Richmond, Ind., and Philip O'Conner, supervisor of Sub-Division 2 of the Ft. Wayne division, at Upper Sandusky, Ohio.

No Let-Up in Expenditures

THE recent break in the prices of stocks will have no effect on the programs of the railways for the improvement of their properties or result in any decrease in the number of employees. This is the reassuring news that was announced following the conference of railway executives with President Hoover on November 19.

"The railway presidents were unanimous," according to the statement made public, "in their determination to co-operate in the maintenance of employment and business progress. It was stated that the railways which they represented would proceed with full programs of construction and betterments without any reference to recent stock exchange fluctuations; that they would canvass the situation as to further possibilities of expansion, and that among these particular railways it appeared that the total volume of such construction work already indicated an increase during the next six months over the similar period of last year."

This preliminary conference with the railway executives was the first of a series of discussions between business leaders and government officials called by the President, in accordance with an announcement he had issued on November 15, in an effort to deal with the feeling of uncertainty that developed after the fall of stock prices which caused people who had lost money in speculation to assume a pessimistic attitude toward the country as a whole. Those present were: The President; the Secretary of the Treasury; the Secretary of Commerce; E. I. Lewis, chairman of the Interstate Commerce Commission; R. H. Aishton, president, American Railway Association; W. W. Atterbury, president, Pennsylvania; J. J. Bernet, president, Chesapeake & Ohio; P. E. Crowley, president, New York Central; Agnew T. Dice, president, Reading; Fairfax Harrison, president, Southern; L. F. Loree, president, Delaware & Hudson; Jeremiah Milbank, Southern; J. J. Pelley, president, New York, New Haven & Hartford; F. W. Sargent, president, Chicago & North Western; Hale Holden, chairman of executive committee, Southern Pacific; Julius Barnes, chairman of board, Chamber of Commerce of the United States, and William Butter-

Photo by Frederick A. Schutz

Railway Executives and Others Who Conferred with President Hoover on November 19 to Plan Co-operation for Continued Business Progress

Sitting, left to right: Agnew T. Dice, R. H. Aishton, Secretary R. P. Lamont, Secretary A. W. Mellon, Hale Holden, L. F. Loree. Standing, left to right: Jeremiah Milbank, J. J. Bernet, Fairfax Harrison, P. E. Crowley, J. J. Pelley, F. W. Sargent, A. W. Shaw, Julius Barnes, William Butterworth.

worth, president, Chamber of Commerce of the United States.

Among the reasons given by President Hoover for his firm conviction as to the stability of American business is the large amount of capital to be made available by the marked decrease in speculation to result from the break in the stock market. "One of the results of the speculation period through which we have passed in recent months," he said, "has been the diversion of capital into the security market, with consequent lagging of the construction work in the country. The postponement of construction during the past months, including not only buildings, railways, merchant marine and public utilities, but also federal, state and municipal public works, provides a substantial reserve for prompt expanded action."

It was agreed that the whole question should be taken up at the meeting of the railway executives in Chicago on November 22, with a view to securing the co-operation of all railways in the United States in this program. At that time steps were taken to canvass the railways to determine the exact amount of construction and betterments which can be undertaken over the forthcoming year and during the next six months.

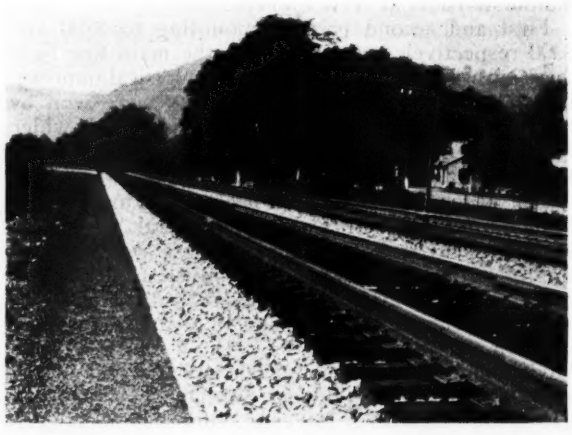
An Impressive Program

How successful this meeting was in bringing the railways wholeheartedly into the spirit of the President's plan is evidenced by a telegram addressed to him by the railway executives. "The executives," according to the telegram, "are proceeding with confidence in the future business prosperity of the country and in reliance upon the full co-operation of industry in all its branches, equally interested under these circumstances.

"It is their hope and expectation to proceed on at least a normal basis in their future capital and maintenance expenditures. A movement to increase them, however, has been started and is being actively and intelligently pressed forward.

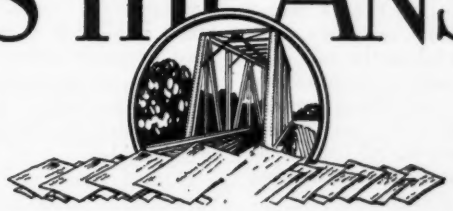
"The program of capital expenditures already arranged for is impressive, amounting up to Oct. 1 of this year to $1,247,792,000 for class I railways, of which $673,972,000 remained on that date to be expended. This figure of $1,247,792,000 compares with a capital program of $902,307,000 for the same period of 1928, an increase of over 38 per cent.

"There are also now on order approximately one and one-half million tons of steel rails for delivery beginning early in 1930. It is estimated that this will be increased by orders for approximately one million additional tons, which would make the rail deliveries in 1930 approximately 2,500,000 tons and substantially in excess of last year."



A Well Defined Ballast Toe Line and a Cinder Shoulder on the Lehigh Valley

WHAT'S THE ANSWER?



Have you a question you would like to have someone answer?

Have you an answer to any of the questions listed below?

QUESTIONS TO BE ANSWERED IN THE FEBRUARY ISSUE

1. *What are the relative advantages of caterpillar and standard railway mountings for steam shovels and locomotive cranes?*

2. *In changing from open to ballast-deck construction, is it good practice to allow existing creosoted pile bents to remain if they are in good condition? If so, should they be cut down, or should the track be raised to accommodate the change, where the grades will permit the latter method?*

3. *Where wood plank is used between the rails at highway crossings and station platforms, what means can be taken to prevent the lifting of the planks as a result of the packing of the snow in the flangeways and under the plank?*

4. *What types of wearing surfaces are most suitable for the floors of overhead wooden bridges?*

5. *What precautions should be taken to protect trackmen against injury by trains when sweeping snow during a storm?*

6. *What is the best method of detecting leaks in underground water lines?*

7. *What is the purpose of a nut lock or spring washer? Does their use improve the condition of the joint, and if so, why?*

8. *What is the best type of roofing for frame stations in small cities, from the standpoints of maintenance and appearance?*

Causes of Rail Batter

What are the causes of rail batter and what means, if any, can be employed to prevent it?

Track Conditions are Largely Responsible

By A. CHINN
Engineer Maintenance of Way, Chicago, Burlington & Quincy, Lincoln, Neb.

Rail batter is caused by any one of a number of conditions, improper expansion being one of the principal causes. Too much expansion allows the passing wheels to hammer on the rail ends, gradually battering them down. Too little will cause the ends to become so firmly pressed together during warm weather that one rail end will invariably roll out a thin sliver over the top of the adjacent one and eventually chip out, leaving a small depression that starts a batter. Other causes are worn or loose angle bars and foul or improperly tamped ballast at the joint ties, giving poor support to the rail ends.

The prevention of batter should commence with the laying of the rail, at which time every precaution should be used to see that proper expansion is secured and that sufficient anchors are placed immediately behind the rail laying machine to insure the expansion being held in place. After the rail is laid, it is necessary, of course, to follow up with several bolt tightenings until the angle bars have become seated properly, after which bolts should be tightened once a year or oftener if conditions require it.

Most new rail is surfaced shortly after being laid so that all joint ties are, as a rule, properly tamped at this time. Keeping them in that condition is a matter of routine maintenance.

All rail will batter to a certain extent in time. This batter sometimes becomes so pronounced as to effect riding conditions of the track while the rail still has many years of life left. Under these circumstances, favorable results are obtained by building up the battered ends by welding, which can be done at a reasonable cost. When welding is to be done, all angle bars should be examined in advance of the welding and any that are worn to the extent that they cannot be properly tightened, or do not provide a good bearing on the fishing of the rail, should be replaced with good bars. Also, all joints should be brought to a good surface and firmly tamped.

Rail Batter Results From Several Causes

By ENGINEER MAINTENANCE of WAY

There are many causes of rail batter, some of which are intimately related while others are independent. The immediate cause is the initial rolling out of the metal at the end of the rail. This may be the result of using a steel that is soft or too ductile, and where this is the cause little can be done to prevent it in rails that are already in service. But even where this is the condition back of the trouble, it can be minimized to a certain extent by proper attention to the details of track maintenance.

Excessive expansion almost invariably results in rail batter, so that the minimum amount of expansion consistent with good practice will tend to reduce the amount of batter that will occur. Worn angle bars and loose bolts are fertile sources of battered rail ends, which, once started, increase progressively until the rail is unfit for further use or must be reconditioned by welding.

Where too little expansion has been allowed, any metal that flows toward the end of the rail will be chipped off when the adjacent rails come into contact from increased temperature. If there is no expansion,

so that the rails abut tightly, the flowing metal laps over the end of the receiving rail and eventually chips off. Battering is much more noticeable and progresses more rapidly in chipped rails, since the wheels give a greater impact as they pass over such rail ends.

Assuming, therefore, that the metal in the rail is of the proper quality, much can be done to minimize the effect of battering by allowing the minimum amount of expansion that is practical, and using care to see that it is properly distributed; by keeping all bolts tight, and by replacing angle bars or joints as soon as they show evidence of wear at the fishing surfaces.

Delivering Water to Coaches

What precautions should be taken to insure the sanitary delivery of water to coaches and dining cars?

Intelligent Supervision Is Most Effective

By C. R. KNOWLES
Superintendent of Water Service, Illinois Central, Chicago

In attempting to answer the above question, it is assumed that it has to do only with the delivery of water from the source of supply to the water container on the passenger coach or dining car, and it is assumed further that the water is of satisfactory quality and meets the required standard of purity and safety prescribed by the interstate quarantine regulations of the United States.

Water is usually delivered to tanks of coaches, dining and sleeping cars either by means of hose or buckets, and the chief danger of pollution of the water is through neglect of these facilities. Less frequently water is handled in bottles or cans. While it is important that both hose and buckets be kept clean, particularly the filling end of the hose, the protection of the hose probably offers the most difficult problem of all, owing to the fact that it is commonly dragged about the station platform and between tracks, where it is subject to contamination not only from ordinary causes, but from the deposits from the hoppers from the cars as well.

Many devices have been used to protect the end of the filling hose, ranging from a sheath similar to the cap on a fountain pen to a large disk six or eight inches in diameter, placed about eight inches back from the end of the nozzle to prevent it from coming in contact with the ground. In other cases the end of the hose has been fitted with a strap to permit the employee using the hose to throw the strap over his shoulder, thus keeping the nozzle free of the ground. These devices are all helpful in preventing pollution of the water, but despite all efforts and devices which may be designed to avoid pollution, the human element is the chief factor. For this reason, unless the devices are used properly they do not give the desired results, and a plain hose end protected from dirt and contamination, and properly washed and flushed when necessary, is ample safeguard against pollution from the hose itself. As a further precaution the hose should be properly cared for when not in use to guard against pollution, preferably by storing in a special locker.

Water buckets frequently are used in filling water coolers on passenger cars. They are usually of a special design, with a cover for protection against dirt, and a spout to facilitate the delivery of water to the coolers. Owing to the various conditions under which these buckets must be used, as for example, the location of the cooler and restricted cooler space, the design of the buckets differs somewhat. Regardless of the type of buckets used, however, proper precautions should be taken to keep them in clean sanitary condition, by washing and steaming, or by the use of some other sterilizing agent. Most important of all in connection with the use of buckets is to take care of them properly when not in use in order to prevent their becoming dirty and contaminated. Ordinarily flushing the bucket with clean water is all that is necessary, provided the bucket has been properly protected against gross pollution.

The most important factor in the sanitary delivery of water to coaches and dining cars is care and intelligent supervision, regardless of what type of facilities are provided.

Bottled water is sometimes used on dining and other cars and, as a rule, this method offers less of a problem, assuming, of course, that the proper precautions have been observed in bottling the water. Certain care is necessary in removing the stoppers from bottles and cans containing water and in protecting the water from pollution after the container is opened. In a test of one hundred samples of water supplied to coaches and dining cars on a middle western railroad some years ago a bottled water showed the worst pollution of any sample submitted. This was undoubtedly due to carelessness in handling the water after it was opened.

More important than any device in the protection of water delivered to passenger cars are definite rules and instructions, followed by careful supervision.

Railway Officers Have a Responsibility

By H. W. VAN HOVENBERG
Sanitary Engineer, St. Louis Southwestern, Texarkana, Tex.

The first essential is the delivery of safe water to the coach-yard or station-platform hydrant from which coaches and dining cars are watered. This safety can be secured by modern water purification methods and control, together with adequate supervision of drinking water supply lines against the possibility of contamination, through relaying or repairing water mains and branches.

The delivery of water from hydrants to coaches and dining cars, as now practiced by railroads, is far from being universally satisfactory, more from lack of proper supervision by superior officers who have no training in or regard for sanitation, than from not having appliances that afford safety in most instances. I refer to the use of the covered or partly covered water buckets and to the watering hose having some sort of metal nozzle and nozzle protecting devices on the filling end. These latter devices, in themselves, have little to do with keeping contamination from the nozzle end, but may serve as a reminder that the nozzle end should be kept off the ground.

Personally, I think that the many efforts to protect a hose end nozzle with protecting shields is a waste of effort and particularly so if the hydrant end of the hose is without any protection. My preference for an economical and sanitary coach yard car water filling layout would be the use of self-closing, non-freezing hydrants, with removable filling hose attached by steam or air coupler, and with the car-filling end of the hose guarded by a metal shield approximately eight inches from the end of the hose and fitted with a valve back of the shield.

In filling a coach or dining car, the end of the hose is slipped over a tapered pipe inlet, attached to the car water storage system. This tapered pipe nipple is protected by a metal box, and should be so located under the car as to prevent contamination from the coach toilets. With this simple arrangement, the employee can flush the tapered pipe end on the car storage system before attaching the hose, so there is little chance of introducing contamination from the hose ends into the car storage system. In place of using the ordinary type of hose, which frays with use, a soft rubber nipple could

be used which would make a tight joint with the tapered car nipple. However, I know of an ordinary garden hose that has been in use for more than six months and is still in good condition. With a proper taper on the car filling water pipe, the watering hose will stay in place while the car watering man attends to other duties.

I believe it is possible to secure a safe water, with less initial cost and maintenance, with this plain hose end than with any of the types of metal attached nozzles that some railways are using today. In any case, however, the closest supervision is necessary to insure safe watering. In places where hydrants cannot be used on platforms because of the possibility of personal injury, it is usually practicable to provide safe connections with a ground flush water box, if good drainage is provided and maintained. Emphasis must be placed on maintenance for I have seen new installations with good drainage which are not being maintained.

In these cases, supervision is at fault and in this, as in the many related phases of railway sanitation, sanitary supervision and instructions should come from men trained in that science.

Replacing Broken Glass

What is the best method of insuring that broken glass will be replaced promptly in engine house windows during the winter?

Method Depends on Conditions

By L. C. Hartley
Chief Engineer, Chicago & Eastern Illinois, Chicago

It is difficult to make a fixed rule for performing this work owing to the fact that some engine houses are so located as to be convenient to the headquarters of the men who are to do the work, while it is very inconvenient to get to others. At places where maintenance of way carpenters or painters are located, it is often well to arrange for a certain day in the week in which they are to inspect the windows and replace all broken glass. At other places, it has been found satisfactory to arrange with the engine house foreman to notify the foreman, or the man who is detailed to handle the work, as soon as glass is broken.

At those points which are difficult for the maintenance forces to reach, it is preferable to arrange for the work to be done by the engine house forces. At outlying points where there are neither maintenance nor mechanical department forces available to do the work, our practice is to have the engine house foreman notify the division engineer who arranges for repairs at the earliest convenient time.

A Regular System Should Be Followed

By Division Engineer

The man upon whom no responsibility rests for replacing broken glass in engine house windows, frequently does not realize the burden that may be placed on the building forces to keep these windows in good repair. For this reason, an indifferent or careless engine house foreman may allow an unreasonable number of panes to be broken. If the responsibility for maintaining the glass in the windows is shifted to his shoulders, however, he may have a change of heart and the amount of broken glass is greatly reduced.

The writer has in mind a case where approximately 700 panes of glass were broken in one 40-stall engine house during a single winter, immediately following the application of superheater units to the locomotives using this house. A conference was arranged with the master mechanic and it was decided that the engine house foreman should be responsible for maintaining the glass in the windows. During the first year succeeding this conference only about 100 panes were broken.

Such an arrangement may not always be possible or desirable, in which cases, if the forces are available, it is a good practice to assign one man from the building gang whose duty it is to make a periodical inspection of the house as frequently as possible, but not less frequently than twice a week, and replace any glass that may be broken. During the summer the interval between repairs may be longer, but even during this season it should be arranged to have the inspection made at regular intervals and not as may be convenient, since the most efficient and economical results are obtained if a regular system is followed.

The Preboring of Ties

Is there any advantage in the preboring of ties? If so, what diameter of hole gives the most satisfactory results?

There Is a Decided Advantage in Preboring

By Lem Adams
General Supervisor Maintenance of Way, Union Pacific, Omaha, Neb.

One of the prevailing causes for the removal of ties in ballasted track is that of decay or mechanical destruction at the rail bearing. Beneath the rail base, or the tie plate, the tie is always under cover and, consequently, moisture settles there, thus providing the conditions which promote decay.

In the case of treated ties, even where they are incised, the treatment does not penetrate very far into the tie, except at the ends or where it follows through at checks or cracks. Therefore, when four holes are bored through the tie at the tie plate bearing, the treating material has an opportunity to penetrate thoroughly into what is otherwise an untreated area. For this reason, I consider that this is the predominant advantage to be obtained from preboring.

The original idea for preboring was to provide a hole for driving the spike in order to insure that it be driven straight into the tie and also to prevent the breaking down on the tie fibers, which occurs when a cut spike is driven into an unbored tie. This later method, of course, breaks the fibers on each side of the spike, and they eventually decay and the spike becomes loose. Where the spike is driven into a prebored hole, the wood is so thoroughly treated around this hole that decay is prevented. Therefore, the fibers remain in good condition and will hold the spike securely in place. The prebored hole is usually 7/16 in. in diameter, which is small enough to hold a standard spike and large enough to prevent the breaking down of the fibers when the spike is driven into the tie.

Preboring Retards Decay

By District Engineer

There is a decided advantage in the preboring of ties, whether they are to be used treated or untreated, but particularly for the former. When screw spikes are used, the preboring of the ties becomes almost a necessity. Driving the ordinary form of cut spike mutilates the fiber of the wood and compresses it to such an extent that, while it increases the initial holding power of a newly driven spike, the holding power is considerably decreased after a comparatively

short time, depending on the species of wood, or after the spike has been withdrawn.

As a result of the lifting action of the rail under the wheels, nearly all cut spikes are raised slightly and the hole becomes worn to some extent, allowing water to percolate around the spike and into the crushed fibers, so that decay soon sets in and progresses to the point that decay around the spike hole is one of the major causes of tie removal. Where the tie is prebored, the fibers are not crushed and their deformation is materially less than in the unbored tie. As a consequence, decay is less rapid, although not entirely eliminated, and the life of the tie is increased.

The preboring of ties that are to be treated affords an opportunity for the treating material to penetrate in all directions from the holes in a zone considerably below the zone which is affected by the surface penetration. This fact is important, because the timber is thus fortified against decay at the point of severest attack by the rot-producing organisms. It is the general experience that preboring not only increases the life of untreated ties, but to a far greater extent prolongs the life of treated ties.

Preparing Water Barrels for Winter

How should water barrels that are provided for fire protection on bridges be prepared for winter, and by whom?

Maintenance of Fire Barrels Is Important

By Division Engineer

The proper maintenance of water barrels for fire protection at bridges is one of the important duties of the division bridge and building forces, and this responsibility should not be divided. When the barrels are placed originally, it is desirable that the section forces shall bury those which are intended for the protection of short spans as they can usually do this work at less cost than a bridge gang. The barrels should be prepared by the bridge men for installation, by applying covers and providing wooden buckets and should be delivered on the ground fully equipped. It is immaterial which department fills them in the first instance, if it is clearly understood who is to do it.

After the barrels are installed, however, the entire responsibility for their maintenance should be borne by the bridge forces. If a proper system of monthly bridge inspection is in effect, the bridge inspector should be required to examine every fire barrel, see that it is properly filled, that the cover is in place and that the bucket has not been removed, and include these items in his regular report.

The preparation of the barrels for winter should be done by placing calcium chloride in every barrel, in excess of what is required to maintain a saturated solution. This is important, because the filling that is necessary from time to time may otherwise weaken the solution to the point where the water will freeze. Late in the fall, a small gang should be assigned to this work and should be required to go over the road, placing sufficient of this chemical in every barrel and filling them with water where necessary. A wood paddle made of second-hand material should be left in every barrel to enable the bridge inspector to stir the solution on his visits to the bridge, thus maintaining the required density.

It has been the experience of the writer that divided responsibility always results in negligence on the part of some or all of those who are expected to look after work, and the maintenance of water barrels at bridges is so important that it is seldom good policy to require the two departments to be jointly responsible for their condition.

The Section Forces Should Prepare Them

By Engineer of Bridges

Water barrels should be provided in the first instance by the division bridge department. When they are intended for the protection of long bridges, the bridge gang should mount and anchor them on the platforms which are provided for that purpose. They should be fully equipped with covers and wood buckets which can be hung inside the barrels.

When they are to serve at short spans, it is usually desirable to bury them in the ground on the shoulder of the embankment, close to the end of the bridge. Barrels for this purpose should also be fitted with covers and be provided with wood buckets, the same as on the longer structures. These barrels should be shipped to the section foreman on whose section they are to be used and he should be instructed to install them at the bridges. In both instances, it should be the duty of the section foreman to see that they are always full of water and that the buckets have not been removed.

All that is necessary to prepare them for winter is to place enough anti-freezing chemicals in the water to insure that the solution will continue to have the proper strength over winter, even though some of the water may evaporate and be replaced during the season. It is important that the water in the barrels be stirred from time to time to insure that the proper strength of the solution will be maintained and this can best be done about once a week by the track walker.

Laying Rail in Winter

When rail is being laid in the winter, what special precautions are necessary in addition to those required in the summer?

No Special Precautions Taken

By G. A. Phillips
Chief Engineer of Maintenance, Lehigh Valley, Bethlehem, Pa.

On the Lehigh Valley we take no special precautions when laying rail in winter, except that shims are applied occasionally where low ties are encountered. We are extremely careful, however, not to allow too much expansion. Our rail is laid fairly tight, even though the temperature may be low.

Preparations Should Start in the Fall

By H. S. Clarke
Engineer Maintenance of Way, Delaware & Hudson, Albany, N. Y.

Where rail is to be laid during the winter when the ballast is frozen, so that it is not practical to do any tamping, it is quite important for the track to be put into good line and surface before freezing weather sets in. At this time the ballast should be lowered below the top and away from the sides of the ties to insure that there will be no interference with the laying of the rail or applying the rail anchors. It is also advisable to score the ties at this time, although the adzing cannot be done until the old rail has been removed.

When the old rail and tie plates have been removed,

the adzing should be done immediately. It is desirable that intensive supervision be given this operation, since unusual care should be taken in adzing to prevent uneven surfaces or low ties so as to avoid all unnecessary shimming.

If the rail is not distributed before the ground is frozen, and particularly if there is snow on the ground to obstruct the view of the uneven surfaces, unusual care should be exercised in unloading the rail to prevent its being damaged.

Track fastenings, such as angle bars, bolts, spikes, tie plates, tie plugs and rail anchors, should not be distributed in advance of one day's work, in order to insure that they will not be lost in case of a heavy snowfall.

When the actual laying of the rail takes place, it is important that snow, ice and frozen ballast shall be removed from the rail and track fastenings and from the ties for several inches beyond the limits of the tie plate. If the new rail is covered with snow or ice, this should be removed before it is swung over the track.

Temperature changes should be watched carefully, particularly as between the early morning and late afternoon and the middle of the day when the sun is high, to insure correct expansion, which is greatest at this time of the year and, if not correct, will cause damage to rail ends.

Shims should be available at all times and used promptly at the time the rail is laid in to correct all places of unequal surface. They should be maintained carefully until it is practicable to tamp the ties, at which time they should be removed and the ties brought to the proper elevation.

The best spikers should be chosen in order to avoid splitting of frozen ties and to avoid injury from flying spikes, which frequently occurs when inexperienced spikers try to start spikes in frozen ties.

Foreman should use extra safety precautions at this time of year, since more clothes are worn by the men, thus hindering the freedom of their movements. The footing is often slippery and the hearing of the men is frequently impaired as a result of the covering they wear over their ears.

Many Special Precautions Are Necessary

By A. CHINN
Engineer Maintenance of Way, Chicago, Burlington & Quincy, Lincoln, Neb.

If the maintenance work is carried out under a system of programming, so that it is known in advance where the rail will be laid, it is a decided advantage to bring the track to the best possible line and surface before it freezes, in order to prevent the new rail from being bent before it can be surfaced the following spring. If a tie scoring machine is to be used in connection with the application of the tie plates, or if a change is made in the width of the base of the rail, it should be run before freezing weather in order to prevent frozen ballast from interfering with its operations.

If the rail is received after the ground is frozen, greater care must be exercised in unloading it to insure that it will not be bent or damaged by striking the frozen ground too hard. When the rail is set in the track, the base should be examined carefully to see that there is no ice or frozen dirt on it which will give it an uneven bearing on the ties or plates.

One of the most important features to be watched is the expansion, since maximum expansion will usually be required at this season. This should be checked at proper intervals during the day with a reliable thermometer and expansion table and the expansion shims used accordingly. Since the expansion will be at its maximum, it is quite essential to follow immediately behind the rail laying machine, applying anti-creepers to hold it evenly distributed.

After the rail is laid, the ties should be checked at once and any that are found below the proper elevation should be shimmed. By exercising proper care, rail can be laid as successfully during the winter months as in the summer and at a very small increase in cost over summer work.

Attention to Expansion Is Important

By J. MORGAN
Supervisor, Central of Georgia, Leeds, Ala.

Since the temperature conditions vary much more during the winter months in the south than at any other time of year, it is of special importance that the temperature of the rail be taken at relatively close intervals during the day in order to provide for the proper expansion when laying rail. It has been my experience that the fluctuations in temperature may be quite rapid and between wide limits, the change frequently being as much as 30 deg. within a few hours. The importance of providing the proper expansion at rail joints is so great that this matter should always be given preferred attention.

Aside from this one item, winter rail laying in the southern territory, with which I am familiar, does not require any special precautions other than those which are required at any other time of the year.

Avoiding Hazards from Ice Jams

Where trouble is experienced with ice jams at bridges, what preparation, if any, can be made at this season to minimize the hazard later in the winter or spring?

Proper Preparation Reduces the Hazard

By SUPERVISOR of BRIDGES and BUILDINGS

While ice jams occur at bridges under a wide variety of conditions, those which develop most frequently and which give the most trouble are usually found at openings which serve small streams that issue from steep, hilly country and cross underneath the tracks, where they are located on the bottom land in the valley of a large stream but close to the hills.

Under these conditions, the ice generally breaks up as the result of heavy spring rains and, since the run-off from the hills is rapid, the rise in the stream is also rapid and the water has little chance to spread out before it reaches the bridge. The ice is, therefore, brought down in large volume and at high velocity so that it becomes tightly packed in and immediately above the opening. This completely blocks the natural channel and, as the water must have an outlet, it flows over the tracks, washing out the ballast, and frequently the embankment and even the abutments of the bridge.

Where such conditions exist, it is important that the channel, both through the opening and for some distance on either side, shall be cleaned of all obstructions and widened and deepened as much as possible before the ground freezes. Ice breakers should be constructed at intervals upstream, composed of scrap rail anchored firmly in the outcropping stone or, in its absence, in heavy concrete foundations. These rails should be set vertically and spaced from 2 ft. to 3 ft. as conditions require. Properly constructed ice breakers often completely eliminate the trouble from ice jams.

Later in the winter and just before the probable break-up, it is desirable to blast out all accumulations

of ice in the channel near the tracks and dispose of it on the downstream side of the bridge in such a manner that it will not obstruct the flow of the ice and water when the rise occurs. It is also desirable to have a supply of high explosives, 40 or 60 per cent dynamite, easily available to aid in the clearing of such jams as occur. Arrangements should be made in advance to have a bridge gang, headed by an experienced foreman, at or near the point where the trouble is likely to occur, so that the work of clearing the ice can be started as soon as the jam takes place. Not infrequently, however, the ice can be guided through the openings by means of pike poles, if the gang is on hand in time, so that the formation of the jam is avoided.

An Unusual and Difficult Situation

By M. F. CLEMENTS
Bridge Engineer, Northern Pacific, St. Paul, Minn.

The only place of importance on the Northern Pacific where ice jams occur at bridges, is on the Missouri river between Mandan, N. D., and Bismarck. The ice in the Yellowstone river, which empties into the Missouri at some distance above these cities, breaks up about three weeks earlier than in the Missouri river at Bismarck. Serious ice jams form near the mouth of the Hart river, another tributary of the Missouri, causing the main stream to leave its banks and flow over an extensive flat adjacent to Mandan.

At this point the main line of the Northern Pacific was purposely constructed below the high water elevation in the Missouri to permit a freer downstream movement of the ice in order not to endanger the city of Mandan. The record indicates that on an average of every seven years, these ice jams cause the ice from the upper river to move across the low ground, blocking railway traffic for a period of one to four days. There is no special preparation that can be made to take care of the damage which results from this condition, since the work of clearing the track cannot be undertaken until the jam has actually occurred. In all probability no attempt will be made to raise the track at this point with the idea of relieving the situation of the railway, since, with the track at a higher elevation, the city of Mandan would be entirely submerged. Should this occur, great property losses would result, not only to private owners but to the Northern Pacific as well.

Minimizing the Heaving of Track

What precautions, other than improved surface drainage, can be taken in the fall to prevent or minimize the heaving of track during the winter?

The Use of Salt Is Recommended

By A. CHINN
Engineer Maintenance of Way, Chicago, Burlington & Quincy, Lincoln, Neb.

Where heaving is confined to short spaces, such as over pipes or box culverts, at bridge ends and at water tanks, treatment with salt has been found to give good results.

Dig out all ballast between the ties and for about two feet out from the ends, to a depth of several inches below the bottom, being careful not to disturb the ballast immediately under the ties. Then fill in with 3 to 4 in. of coarse salt, on top of which replace the ballast. Any surplus ballast can be kept in a pile for filling in later as the salt dissolves.

The fall rains will percolate through the salt, dissolving a certain portion each time and carrying it down into the ballast and subgrade. This salty solution will not freeze at the temperatures that usually prevail at a depth of 10 or more inches below the surface. Consequently, the formation of frost and the resulting heaving is stopped.

Temporary Relief Does Not Cure Heaving

By G. STAFFORD
Section Foreman, Canadian National, Rosebud, Alta.

One of the penalties of imperfect or inadequate drainage is heaving track, since it is the result of the expansion of the moisture in the ballast and roadbed while freezing. If all of the soil composing the roadbed possessed the same capacity for holding moisture, the heaving would not be noticeable since the expansion would be uniform. Frequently the roadbed is composed of variable soils in close proximity and of different moisture-retaining capacities, which under frost action, develop irregular expansion, resulting in uneven surface and alinement.

In a cut through hardpan, heaving is scarcely noticeable. On the adjoining embankments, particularly if they are shallow, where the roadbed is composed of the excavated material, usually containing a fairly large proportion of loam, there may be considerable heaving. This is also true of shallow cuts where very little depth has been necessary to reach subgrade and loam or soil of a spongy nature has been left in the roadbed. Where the heaving is not too severe, the carrying of the side ditches to a depth of three feet below the base of the rail may entirely cure the trouble. Where considerable heaving occurs, the faulty material should be removed from the roadbed by digging-out and be replaced with gravel.

Too light an initial application of ballast upon a newly constructed roadbed, by reason of its failure to distribute the impact of the wheels properly, will result in a short time in a series of corrugations of the subgrade itself. Water collects in these depressions and in freezing weather the conditions are ripe for heaving. Temporary relief may be obtained by cleaning out the cribs and inserting a light application of cinders under the ties and tamping them uniformly throughout their length and then replacing the ballast.

Where heaving is due to the presence of water pockets in the subgrade, it will be necessary to remove the ballast shoulder and plow off the ridge or hump obstructing the drainage of the roadbed. In some cases, examination will show that merely a sod or grass edge on the extreme shoulder of the roadbed is obstructing the drainage and when this is removed the heaving is stopped.

Sidehill track, resting partly in cut and partly on fill is particularly susceptible to heaving. Quite frequently the subsoil of the slope is intersected by underground springs which may be very small but which keep the roadbed in a moist condition, and may result in severe heaving during the winter.

At times a troublesome form of heaving, which is independent of subgrade conditions, occurs as a result of the drainage through the ballast becoming impaired. In such a case a thorough cleaning of the ballast shoulder will reduce or entirely eliminate the trouble, and this can be done just far enough in advance of freezing to insure that the ballast will be well dried out before winter.

In practically all cases of heaving track, some adequate subsoil drainage system is necessary well below frost line, if permanent relief is to be secured. It should be borne in mind that superficial measures will afford only temporary relief, and until some efficient system of subsurface drainage is installed that will eliminate the trouble, the heaving will recur year after year.

Filling the Track

A further answer to the following question, which was discussed in the September issue:

When the track is being reballasted, should it be filled and dressed as soon as the final lift is completed or should it be left open for a few days to expedite the picking up of the slack places?

The Track Should Be Left Open

By J. B. MARTIN
General Inspector of Track, New York Central Lines, Cleveland, Ohio

When track is reballasted it is usually raised from 8 in. to 12 in. and, as there will be some lack of uniformity in the tamping as well as height of the raise, there is sure to be some unevenness in the settlement. To take care of this, the track should be thoroughly resurfaced after a few days. The track should not be filled and dressed until after this resurfacing is completed. This will facilitate the picking up of the slack places and obviate the double expense of filling and dressing, and then digging out and redressing.

Pipe or Box Culverts?

A further answer to the following question which was discussed in the November issue:

What factors should govern in determining whether a pipe or a box culvert should be used for any given opening?

There Are Four Principal Factors

By E. A. FRINK
Principal Assistant Engineer, Seaboard Air Line, Savannah, Ga.

If the foundations under the culvert are untrustworthy, a pipe culvert is not as desirable as a box culvert because it is discontinuous at all joints and, therefore, has little resistance against either vertical or lateral displacement. If there is any question about the reliability of the foundation, a box culvert should be constructed.

If there is any prospect of the culvert being moved or discontinued in the future, the pipe culvert has the advantage that it has a high salvage value, whereas the box culvert would be a total loss. In locations suitable for pipe culverts, therefore, they should be used if there is any expectation of future change.

It is possible that in certain materials, the fill may have a tendency to misplace the culverts and, if so, a box culvert is more reliable.

If the three preceding factors are favorable to the use of pipe culverts, the fact that they usually cost less than box culverts is likely to be the deciding factor.

Placing Snow Fences

A further answer to the following question which was discussed in the November issue:

Should snow fences be set parallel or at an angle to the track, and if the latter, at what angle? How far back from the track should they be placed?

Snow Fences Are Generally Set Parallel

By L. W. ALTHOF
Engineer Maintenance of Way, Oregon Short Line, Pocatello, Idaho

It is the general practice in the territory with which I am familiar to set snow fences parallel to the track, but where the direction of the prevailing winds do not permit this, the fence should be set at right angles to this direction. Snow fences should not be set closer than 50 ft. from the center of the track unless there are some particular topographical conditions which do not permit them to be set further back.

Eagle Nest Tunnel, on the C. M. & St. P. & P., on the Main Line to the Pacific Coast

New And Improved Devices

A Collapsible Snow Fence

A NEW type of snow fence, known as Snow-Bar, and involving a new type of post, is being manufactured by the George L. Burrus Company, Lithia, Mass., for which many advantages are claimed. This fence consists of two-part folding posts, erected in the form of an inverted "V"; one leg of the posts being provided with six slots of sufficient size to carry the ends of two, one-inch by six-inch, rough-sawed boards, which are purchased separately. The new posts, which are made of a rust-resisting material and weigh 20 lb. each, are of sufficient length to provide a five-foot fence, and are readily collapsible for storing when not in use.

In erection, the posts are spread and forced into the ground until an anchor slot at the bottom is even with the surface of the ground. A wooden stake is

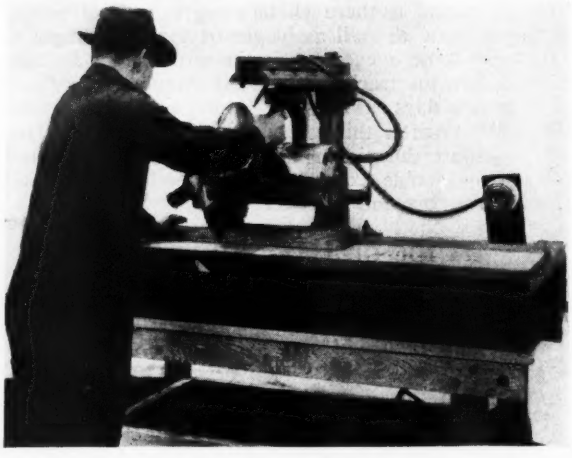
A Section of Snow-Bar Fence as Erected

then driven into the ground diagonally through the anchor slot to hold the fence rigidly in place. Fourteen-foot boards are recommended in the construction of the fence, these boards being slipped into the slots provided in the posts and allowed to overlap each other at the ends. Following this recommendation, about 100 ft. of 5-ft. fence can be constructed with 8 posts and 309 board feet of lumber.

An Improved Woodworker

WITHOUT sacrificing the portability or the versatility of the De Walt woodworker, the De Walt Products Corporation, Leola, Pa., has developed improvements in its Model "D" machine which make possible the delivery of fully 50 per cent more power to the work, whether ripping, cross-cutting, dadoing, mitering, beveling or any of the 29 other operations that are done on this one machine by various tool attachments.

The Model D De Walt Wonder-Worker is powered by a two or three-phase five-horsepower motor



The New De Walt Woodworker

of new design, which provides greater power on full load, and less temperature rise. This machine rips 4-in. fir at the rate of 50 lin. ft. per min. It cross-cuts 6-in. material and can be switched instantly from cross-cutting to ripping without turning off the power. The cutting tool is completely guarded.

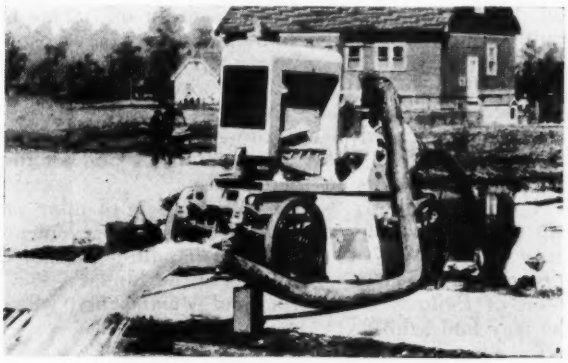
Another improvement in this model is the placement of the dial plate with degree markings and pitch scale directly in front of the operator for easy adjustment for angle and bevel cutting. The dial plate is notched at each 45 deg. for the quick finding of such angles. The motor is locked instantly and securely in any cutting position by means of a positive locking device and a convenient hand lever, so that all changes in adjustment are made instantly and surely.

A New Portable Trash Pump

FAIRBANKS, Morse & Co., Chicago, in conjunction with the C. H. & E. Manufacturing Company, Milwaukee, Wis., has developed and placed on the market a portable trash pump, which is designed to handle fluids containing large quantities of foreign matter. This device consists of a Fairbanks-Morse wood trash pump, powered with a C. H. & E. gasoline engine mounted on a single frame.

The units are manufactured in sizes ranging from No. 4 to No. 8, the figures representing the diameter in inches of the suction and the discharge. It is possible to obtain various combinations of engine sizes and suction and discharge diameters to fill practically any requirement of head and discharge capacity. The power ratings for the standard sizes are as follows: No. 4, 15 hp.; No. 5 and No. 6, 20 hp.; No. 7, 30 hp., and No. 8, 45 hp. The No. 4 size, which is the more commonly used, has a 9¾-in. impeller and is rated at

400 g. p. m. for a 50-ft. lift or 800 g. p. m. for a 35-ft. lift, both at a speed of 1,450 r. p. m. At an engine speed of 1,150 r. p. m., the output is 800 g. p. m. for a maximum lift of 20 ft., while the lift at the maximum speed of 1,700 r. p. m. is 100 ft. and at 1,450 r. p. m. is 65 ft. These units may be obtained in capacities up to 2,500 g. p. m. at a lift of 35 ft. The No. 4 combination weighs approximately 1,900 lb. and is confined to an area of about 4 ft. by 7 ft.

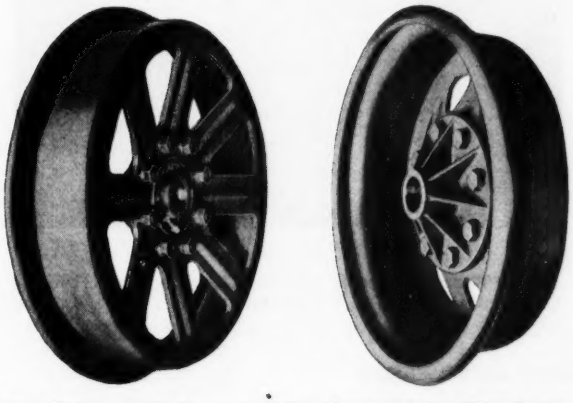


A Trash Pump Mounted on a Truck

Although these pumps are designed to pass a sphere one inch smaller in diameter than the pump suction, or one less than the number size of the pump expressed in inches, this is actually not possible, since the intake hose is provided with a single cross bar to prevent the entrance of any irregular shaped object which might become lodged in the hose.

Fairmont Demountable Wheels

MODERN automobile practice has now been applied to section and extra gang motor car wheels by Fairmont Railway Motors, Inc., Fairmont, Minn. Instead of carrying the whole wheel when a tire wears out, eight 5/8-in. nuts are removed and a new pressed steel wheel blank or "tire" is bolted onto the hub, which remains permanently in position on the axle. Tests are said to have shown this bolted hub construction to be stronger and less subject to loosening than the best riveted hubs. The bolt circle, 6 3/8 in. in diameter instead of the usual 5 in., and Parkerized lock washers, secure the nuts. The tires are made in two sizes, 16 in. and 20 in.



The Fairmont 20-In. and 16-In. Demountable Wheels for Motor Cars

Since the hub is not pulled from the axle, it is not necessary to refit spoiled insulation, or to engage and re-aline wheels when a tire wears out. One man can change tires in the field without outside help, eliminating the necessity of taking a car out of service and shipping it to the shop. Further, if any bolt becomes loose, it is possible for the car operator to tighten the nut with an ordinary wrench. After all cars are once equipped with bolted hubs, a hub stock of one or two of each size, and 50 tires are said to be ample. The use with these wheels of Fairmont hubs, which are furnished in any size and taper of bore, reduces the wheel stock for all cars to two tire sizes or to four items if both 1/4-in. and 5/16-in. tires are used.

A New Acetylene Generator

THE Alexander Milburn Company, Baltimore, Md., has developed a new portable acetylene generator for welding and cutting, which has a number of new features, and which has undergone successfully a series of tests by the Underwriters' Laboratories, Inc. One of the most unique features of the generator is the body which is of drawn seamless steel, making the generator as a whole lighter in weight, stronger and more dependable than bodies with the usual type of joints.

The New Generator

The new generator, which is made in three sizes, 35, 70 and 100-lb. capacity, is extremely simple in that it has no clocks or motors, and few moving parts. The carbide hopper feed control and head are assembled in one unit which can be detached from the seamless steel body by the removal of a few bolts. The carbide feed is controlled by a single valve which responds to both high and low pressure, and which stops automatically if the pressure is at zero, if the filler plug is open, or if the generator is not properly closed.

The control and operation of the new generator is simple, while it is said that the carbide feed is uniform, and that there is complete consumption of the entire charge of carbide. The machine is equipped with specially developed blow-off valves, a pressure control device, a safety gas purifier, and a strainer, and the component parts of the machine are made with over-size outlets, all welded into the seamless body of the generator. The body has protective coatings both inside and out, and the handles for moving it about are of ample size, and welded onto the body.

It is said that one of the notable features of the new generator is its safety of operation, tests by the Underwriters' Laboratories having demonstrated that it can be tipped and upset under different conditions of usage without causing a rise in the pressure of the gas or abnormal working of the machine. The cost of generating acetylene gas in the new Milburn generator is approximately 1 1/8 cents per cu. ft., which gives it a high factor of economy.

What Our Readers Think

Hazards of Roof Truss Inspection

Detroit, Mich.

To the Editor:

I was particularly interested in an article in the September issue of *Railway Engineering and Maintenance*, describing the manner of making repairs to the under surface of the Illinois Central station at Chicago. Those who have never worked under conditions such as were encountered in this task find it difficult to appreciate the handicaps under which it was conducted.

In 1906, the writer was assigned to the inspection of the roof trusses in the Jackson, Mich., and West Detroit enginehouses of the Michigan Central. These trusses, which were constructed about 1883, were of the type formerly called the Fink truss. The inclined compression members were timbers 10 in. by 12 in. in dimensions, while the intermediate compression members were cast iron and the tension members were rods. Being a new and inexperienced inspector, I examined the trusses very carefully and with the aid of a long extension ladder inspected the tension rods in the peak. I found that these rods, which were originally 1⅛ in. in diameter, had been reduced by corrosion to a diameter of ⅜ in. Since gas and smoke were so dense, the inspection of these rods was a hazardous undertaking and I would not attempt it again without having the enginehouse cleared of locomotives.

As my report showed the enginehouse to be in a dangerous condition and likely to collapse at any moment, timber bents were constructed under each truss.

J. S. Huntoon,
Assistant Bridge Engineer, Michigan Central

Handling Creosoted Ties

Macon, Ga.

To the Editor:

Please refer to the letter from L. E. Keller, under the head of "What Our Readers Think," in the Septemper issue of *Railway Engineering and Maintenance*, dealing with the complaint of railway employees handling creosoted cross ties. It is seldom practicable to allow creosoted cross ties to dry out at the treating plant before shipping them out on the road, for such a practice would require a great deal of storage space and would introduce a fire hazard which would be tremendous.

Coal cars and stock cars constitute the only equipment suited to the shipping of creosoted cross ties, and my observation has been that it is safer and less disagreeable to unload treated ties from coal cars than from stock cars. There are still in service a great many gondolas with wooden floors, but even where all-steel cars with no bottom doors are used for these shipments, small leaks often develop around the rivets and seams, sufficient to permit the surface oil dripping from treated ties to drain off. This is quite noticeable on the line-up track of a creosoting plant.

The slippery condition in the bottom of steel cars will occur, no matter how little loose creosote is present. Men engaged in unloading ties from such cars should have good soles on their shoes, and should not have hob nails in their shoes.

I would refer Mr. Keller to an article of mine on the precautions which should be taken to prevent injury to the eyes and skin when handling creosoted ties, which appeared on page 30, of the January, 1927, issue of *Railway Engineering and Maintenance*, which he may find helpful.

L. H. Harper,
Superintendent Creosote Plant, Central of Georgia.

By Courtesy of the Cleveland Trust Company, Cleveland, Ohio

The "Terminal Tower" of the New Cleveland Union Station

The Railway Industry at a Glance

Operating revenues and expenses of the Class I steam railways in the United States, from data compiled by the Bureau of Statistics, Interstate Commerce Commission

	Month of September			Nine months ending with September		
	1929	1928	Increase 1929 Over 1928, per cent	1929	1928	Increase 1929 Over 1928, per cent
Total Operating Revenues	$566,719,557	$556,915,838	1.8	$4,775,112,965	$4,541,847,582	5.1
Expenditures for maintenance of way and structures	**77,509,244**	**74,975,150**	**3.4**	**655,499,440**	**639,020,840**	**2.6**
Total Operating Expenses	383,349,136	376,241,047	1.9	3,414,375,651	3,346,368,629	2.0
Net Railway Operating Income	133,898,015	134,491,321	0.4*	960,078,700	820,572,952	17.0

*Decrease

WITH THE ASSOCIATIONS

The Roadmasters Association

The executive committee will meet at the Hotel Stevens, Chicago, on Saturday, December 7, to select the personnel of committees and to transact other business.

The Bridge and Building Association

The executive committee will meet at the Chicago Engineers Club, Chicago, on Saturday, December 7, to select committees to investigate and report on the subjects selected at the New Orleans convention and otherwise to organize the work of the association for the current year.

International Track Supervisors Club

The meeting of the International Track Supervisors Club which was to have been held at the Hotel Statler, Buffalo, on November 21, has been postponed to December 5. Following luncheon at 1 p. m., the annual business meeting will be held, at which the principal business to be transacted will be the election of officers for the ensuing year.

Metropolitan Track Supervisors Club

The last meeting of the Metropolitan Track Supervisors Club to be held this year will convene at Keen's Chop House, 72 W. 36th Street, New York City, on December 12. Luncheon will be served at 12:30 p. m., following which there will be a discussion of The Use of Labor Saving Devices. A paper on this subject will be presented by a committee of which F. W. Biltz, supervisor on the Reading, is chairman.

Maintenance of Way Club of Chicago

The second meeting of the current season was held at the Auditorium hotel on Wednesday evening, November 20, when Dr. Hart E. Fisher, chief surgeon of the Insull railway and public service properties, gave a talk on "The Maintenance of Men." In addition to Dr. Fisher's remarks, which related to measures for safeguarding the health of employees and caring for them in case of accidents, the program included a demonstration of first-aid work by a group of public service employees. The attendance was 70.

American Railway Engineering Association

Secretary E. H. Fritch returned to Chicago on November 22 after an absence of eight weeks on a trip to the Orient, during the course of which he attended the World Engineering Congress at Tokyo, Japan, from October 29 to November 7. He arrived in Japan on October 15 and made a tour of southern Japan, Corea and South Manchuria, during the entire course of which he was accompanied by Japanese railway officers, with most of whom he was personally acquainted by reason of visits they had made to his office during tours of the United States. Mr. Fritch was delighted with his experiences on this memorable trip and spoke highly of the courteous treatment he received during the course of his entire visit to Japan.

The secretary's office now has in hand or in process of printing all of the committee reports except three. Of these, that of the Committee on Economics of Railway Operation was gone over in final form at a meeting held on November 19 and will be turned over to the secretary in a few days. The other two reports, those of the Committee on Buildings and the Committee on Signals and Interlockings, will be completed shortly.

The Committee on Outline of Work and the Committee on Personnel of Committees held meetings on November 21, the results of which will be made known during the latter part of December in the form of a special bulletin containing the subject assignments and personnel of all the committees.

The Wood-Preservers' Association

Arrangements for the special train enroute to the convention and for the program at the convention, which will be held at Seattle, Wash., on January 28-30, 1930, are rapidly assuming final form. The details of the special train and the stops, including the inspection of treating plants enroute, were published in the November issue, page 519.

Special features of the program, in addition to the reports of committees, include the following papers:

"The Southern Pacific's Experience with Creosoted Douglas Fir Ties on Its Western Lines," by W. H. Kirkbride, engineer maintenance of way and structures, Southern Pacific Company, San Francisco, Cal.

"The Use of Treated Timber and Lumber in Dock Construction," by R. J. Middleton, assistant chief engineer, Chicago, Milwaukee, St. Paul & Pacific, Seattle, Wash.

"Service Records on Treated and Untreated Fence Posts," by R. M. Wirka, Forest Products Laboratory, Madison, Wis.

"Zinc Chloride as a Wood Preservative—Past, Present and Future," by L. C. Drefahl, Grasselli Chemical Company, Cleveland, Ohio.

"The Quesnel Bridge," by P. E. Philip, deputy minister and public works engineer, Department of Public Works, Province of British Columbia, Victoria, B. C.

"The Preservative Treatment of Engelman Spruce Ties," by J. D. MacLean, Forest Products Laboratory, Madison, Wis.

"A New Test for Fire Resistance of Wood and Some Results Obtained With It," by George M. Hunt and T. R. Truax, Forest Products Laboratory, Madison, Wis.

In addition, the termite problem will be the subject of papers by Dr. S. F. Light, assistant professor of zoology, University of California, Berkeley, Cal., and Dr. Thomas E. Snyder, senior entomologist, Bureau of Entomology, United States Department of Agriculture, Washington, D. C.

The nominating committee has presented its report and ballots containing the following nominations have been mailed to members within the last few days:

President, C. C. Cook, maintenance engineer, Baltimore & Ohio, Baltimore, Md.

First vice-president, J. S. Penney, general superintendent of plants, T. J. Moss Tie Company, St. Louis, Mo.

Second vice-president, Elmer T. Howson, editor, *Railway Engineering and Maintenance*, Chicago.

Secretary-treasurer H. L. Dawson.

Members executive committee, F. D. Mattos, manager treating plants, Southern Pacific Company, West Oakland, Cal., and R. H. Moore, general manager, American Creosoting Company, Inc., Louisville, Ky.

Directory of Associations

American Railway Bridge and Building Association—C. A. Lichty, secretary, 319 North Waller avenue, Chicago. Next convention, October 21-23, 1930, Louisville, Ky.

American Railway Engineering Association (Works in co-operation with the American Railway Association, Division IV).—E. H. Fritch, secretary, 431 South Dearborn street, Chicago. Next convention, March 11-13, 1930, Palmer House, Chicago.

American Wood-Preservers' Association, H. L. Dawson, secretary, 228 North La Salle street, Chicago. Next convention, January 28-30, 1930, Seattle, Wash.

Bridge and Building Supply Men's Association—W. H. Lawrence, secretary, Johns-Manville Corporation, 41st street and Madison avenue, New York. Annual exhibit at convention of American Railway Bridge and Building Association.

National Association of Railroad Tie Producers—Roy M. Edmonds, secretary, Syndicate Trust Building, St. Louis, Mo. Next convention, April 29-May 1, 1930, Memphis, Tenn.

National Railway Appliances Association.—C. W. Kelly, secretary, 1014 South Michigan avenue, Chicago. Annual exhibit during convention of American Railway Engineering Association.

Roadmasters' and Maintenance of Way Association.—T. F. Donahoe, secretary, 428 Mansion street, Pittsburgh, Pa. Next convention, September 16-18, 1930, Chicago.

Track Supply Association—L. C. Ryan, secretary, Oxweld Railroad Service Company, Chicago. Annual exhibit at convention of Roadmasters' and Maintenance of Way Association.

RAILWAY NEWS BRIEFLY TOLD

A program involving the elimination of more than 200 highway grade crossings in 1930, has been announced by the New York State Public Service Commission. The estimated cost of the present proposal is about $27,000,000.

During the first six months of this year, 1,120 persons lost their lives as a result of accidents at highway grade crossings, an increase of 23 compared with the same period in 1928, according to reports filed by the railroads with the Interstate Commerce Commission. Persons injured totaled 3,026, an increase of 92.

The St. Louis-San Francisco has offered its employees 2,500 shares of preferred stock at $92.50 per share, without banker's commission. No more than five shares may be purchased by any one employee and payments are made by 12 monthly deductions from the payrolls, beginning with the first half of November.

R. L. Bobbit, attorney general of Texas, has ruled that the Texas full-crew law, which requires every train operating outside of yard limits to be manned by an engineman, a fireman, a conductor and a brakeman, applies to rail motor cars and motor trains operated by railroads, as well as trains propelled by steam locomotives.

A baseball game between the Missouri Pacific system championship team, and the system winners of the Pennsylvania, at St. Louis on October 12, for the "championship of the world" was won by the Missouri Pacific. This game was witnessed by more than 15,000 employees of these roads, who arrived in more than 20 special trains.

The Interstate Commerce Commission, on November 4, issued a formal order directed to the railroads, which are members of the Association of Railway Executives, requiring them to discontinue the transportation or movement of private passenger train cars, including so-called office cars, of another carrier free or at other than published tariff rates. This order becomes effective on January 15, 1930.

President Hoover is understood to be giving consideration to the names of several candidates suggested to him by senators for appointment to the Interstate Commerce Commission as successors to Commissioners R. V. Taylor, of Alabama, and J. B. Eastman of Massachusetts, whose terms expire at the end of the year. The Virginia senators have recommended James P. Wood, of Roanoke, Va., formerly a member of Congress, while the North Carolina senators have recommended Allen J. Maxwell, of Raleigh, N. C., formerly a member of the North Carolina commission.

Five hundred employees of the Toledo, Peoria & Western, members of the conductors', firemen's, operators' and maintenance of way unions, went out on strike on November 13, following failure of federal mediation to bring about a settlement of difficulties between the management and shop employees, over a refusal to recognize or deal with various shop crafts organizations affiliated with the American Federation of Labor.

The traffic in fresh fish from Boston, Mass., to western and southern states, which has been steadily increasing within the past few years, had risen by the end of September to a point where the New York, New Haven & Hatrford carried in that month, 5,500 tons of this commodity, an increase of 1,800 tons over the same month of last year. It is said that the remarkable increase in this traffic is due largely to the adoption of the filleting process and to improved methods of chilling.

Revenue freight car loadings showed a slight recession, as compared with last year, for the three weeks ending with November 9, although there was a substantial increase over the same period in 1927. For this period, the loss, as compared with 1928, was 66,334 cars, while the gain, as compared with 1927, was 127,910 cars. The cumulative total for the 46 weeks of the current year was 46,678,086 cars, which exceeds by 1,586,147 cars the loading for the same period in 1928, and by 1,026,251 cars that for 1927.

A Period of Achievement

During the first nine months of 1929 the railways have been operating more efficiently than ever before. An index of this efficiency, based on 13 commonly utilized factors of performance, shows that, compared with the average for the period from 1920 to 1924, taken as 100, the index figure for the first nine months of this year was 121.6. In respect to 11 of these 13 factors, the performance for this period was the best in history.

In this nine months the roads have had in reserve a daily average of 5,495 locomotives and 237,433 freight cars in serviceable condition and ready for any traffic demands. Car shortages have continued at a negligible minimum.

A shipment of 120-ft. fir piling, aggregating 1,500 cars, moved recently from the Pacific Northwest to Edgewater, N. J., where the piles will be used in the construction of an automobile plant. This shipment moved over the Northern Pacific and the Chicago, Burlington & Quincy to Chicago and thence over various roads. This is believed to be the largest movement of this type ever made, surpassing a shipment of 250 loads made to Canada several years ago.

Directors of the Chicago Great Western have decided to depart from the custom of holding all meetings in Chicago. Believing that the best interests of the railroad will be served if they can establish close contact with the problems of the territory which the road serves, the board of directors will meet in other important centers on the Great Western's lines whenever possible in the future and confer with business men of that section on the particular traffic problems of the territory.

Employees of the Southern Railway have voted to establish a system of pensions or annuities for individuals retiring at 65 or 70 years, and also a system of health and accident insurance. For this purpose, they have formed the Southern Railway Employees' Pension Association. All employees of this road and its affiliated companies with a continuous service record of two years, who are under 70 years of age, are eligible for membership in the pension scheme. The plan provides for the purchase of units of a minimum premium of $2.50 a month and the number of units purchased by any employee will depend upon the amount of income he desires after his retirement. Although there is no compulsory retirement age, the plan provides for two classes of subscribers: Those aged 50 and under at date of entry, a retirement age of 65 years, and for those aged 51 and over at date of entry, a retirement age of 70 years. However, payments may be continued after the retirement age has been exceeded and the income after actual retirement will be proportionately increased. All employees of this road are eligible for membership in its group accident and health plan without a medical examination. The insurance and pension plans became effective November 1, and either or both are available to any employee.

Construction News

The Abilene & Eastern, which has been formed to construct a line between Cross Plains, Tex., and Abilene, about 45 miles, has been granted a charter by the secretary of state of Texas. The proposed railroad, of which Frank Kell, president of the Wichita Falls & Southern, is president, will connect with the Missouri-Kansas-Texas at Cross Plains.

The Atchison, Topeka & Santa Fe has let a contract to W. A. Smith & Son, Fort Madison, Iowa, for the construction of an addition to the enginehouse at Shopton, Iowa, which will include shop facilities.

The Boston & Maine is to undertake a $3,000,000 improvement program on its main line in northern New England. The work covered includes a considerable number of new steel bridges and the reconstruction of the Sugar river viaduct at West Claremont, N. H., at an elevation 20 ft. higher than at present, while other bridges will be strengthened and extensive fills made to eliminate sags. Work on these projects will be started immediately and will be completed within a year.

The Canadian National has awarded a contract for clearing the right of way, grading and the installation of culverts for the construction of a branch line from St. Walburg, Sask., to Bonnyville, Alta., 126 miles, to the Tomlinson Construction Company, Winnipeg, Man., and the Western Construction Company, North Battleford, Sask. The estimated cost of this line is more than $4,000,000. A contract for the clearing, grading and installation of culverts for the construction of a branch line from Hamlin, Sask., to Glenbush, 32 miles, has been awarded to Gibbs Brothers, Lumsden, Sask., at a total estimated expenditure of $1,150,000. This road has also awarded a contract to W. A. Mackey, Toronto, for grading and other work on a new spur line from M. P. 2 on the Waite-Montgomery branch to the Amulet mine, near Rouyen, Que., 2.5 miles.

The Central Railroad of New Jersey has awarded a contract to the Nicholson Company, Inc., of New York City, for the construction of a coal storage plant at Caven Point, Jersey City, N. J., at a total cost of $56,500.

The Chicago & North Western has let a contract to G. A. Johnson & Son, Chicago, for the construction of an addition to the roundhouse at Council Bluffs, Iowa, at a cost of about $50,000.

The Cleveland, Cincinnati, Chicago & St. Louis has awarded a contract for the construction of a two-story passenger station at Linndale yards, Cleveland, Ohio, to the Cleveland General Construction Company, Cleveland, Ohio, at a cost of $150,000.

The Galveston Wharf Company is receiving bids for the construction of the superstructure and the installation of equipment for a reinforced concrete grain elevator at Galveston, Tex. It includes a steel shed 84 ft. by 282 ft., 4 receiving elevator legs and 16 power grain shovels.

The Grand Trunk Western has awarded contracts for the construction of a locomotive terminal at Pontiac, Mich., which involves a total expenditure of about $400,000. The work to be done includes the construction of a 10-stall enginehouse, with 15 outside tracks and a 90-ft. three-point turntable, a powerhouse, a machine shop, a 100,000-gal. steel water tank, and other incidental items, including a direct steaming system for locomotives. The contractors include the Ellington Miller Company, Chicago, the Rust Engineering Company, Pittsburgh, Pa., the Bethlehem Steel Company, Bethlehem, Pa., the Chicago Bridge & Iron Works, Chicago, the Johnson, Larsen & Co., Detroit, Mich., and the Ogle Construction Company, Chicago.

Contracts have been let to the Walsh Construction Company, Chicago, for the construction of an office building, freight house and transfer platform at Elsdon yards, Chicago, and a passenger station in the same city. The cost of these latter projects will be about $140,000. A contract has been let to P. T. Clifford & Son, Valparaiso, Ind., for the construction of three highway subways, five overhead highway bridges and a bridge over the Clinton river, which will include two 125-ft. spans, on the new belt line around Pontiac at a total cost of $285,000. A third project at Pontiac consists of the excavation of 180.000 cu. yd. of material to provide a 200-car capacity yard adiacent to the plant of the General Motors Corporation and a subgrade for future grade reduction and double-tracking of the main line.

More New Lines Proposed

During the month, more than 400 miles of new lines, which will cost approximately $16,000,000, were either announced or placed under construction, while the Interstate Commerce Commission has held hearings on, or received requests for authority to build, two other projects which total more than 380 miles. In addition, construction work was started on a number of projects involving revisions of grade and alinement and the building of second track. A single project, involving an expenditure of $30,000,000 for a new line, which includes a complete revision of passenger facilities and the elimination of grade crossings through the city of Syracuse, N. Y., has been made the basis of an application to the Interstate Commerce Commission by the New York Central. Other work including grade crossing elimination, engine terminal facilities, new stations, bridges, grain elevators and water service facilities were authorized, of a total cost exceeding $7,500,000.

The Great Northern has awarded a contract for the construction of a water supply reservoir at Bainville, Mont., to A. Guthrie & Co., St. Paul, Minn. The reservoir, which will be 150 ft. wide, 1,500 ft. long and about 20 ft. deep, involves the excavation of approximately 100,000 cu. yd. of material.

The budget of the Great Northern for 1930, authorizes the installation of new stationary power-plants at Willmar, Minn., Williston, N. D., Havre, Mont., Great Falls and Whitefish, at a total cost of about $400,000. It is planned to install boilers which will burn pulverized coal.

This road has announced plans for the construction, at a cost of about $600,000, of a 3,000,000-bu. capacity addition to its grain elevator at Superior, Wis., which is operated under lease by A. D. Thomson & Co. When the addition is completed, the elevator will have a total storage capacity of 13,000,000 bu. The new construction will consist of 239 circular bins, each 110 ft. high and 14 ft. in diameter, with a capacity of 12,500 bu. each.

The Lehigh & New England has awarded a contract to the M. A. Long Company, Baltimore, Md., for the construction of an office building at Allentown, Pa.

The Michigan Central has let a contract to the Ellington-Miller Company, Chicago, for the construction of a one-story brick freight station at Windsor, Ont., which will have outside dimensions of 50 ft. by 500 ft.

The Missouri Pacific has let a contract to the Winston Brothers Company, Minneapolis, Minn., for grading and tracklaying in connection with grade revision at Lyndon, Kan., and Madeline and between Rapp, Kan., and Admire. These projects involve the excavation of about 323,000 cu. yd. of earth and 66,000 cu. yd. of rock.

This road has awarded a contract to the M. A. Long Company, Baltimore, Md., for the construction of a grain elevator between Martin avenue and the Missouri Pacific southwest junction yard at Kansas City, Mo. The approximate cost is $145,000.

The New York Central has applied to the Interstate Commerce Commission for authority for a change of line and the abandonment of certain trackage between East Syracuse and Syracure, N. Y., in connection with a grade separation plan required by an order of the New York Public Service Commission. The complete plan, which has been under consideration for some years by officers of the city and the railroad, includes the construction of a new passenger station on a site north of the present station, and involves a total expenditure estimated at approximately $30,000,000.

The New York, New Haven & Hartford has authorized the construction of

a switching lead track at Roxbury, Mass., at a probable cost of $38,000 and the erection of a traveling crane at the Brewery Street freight yard, New Haven, Conn., at a cost of approximately $36,000. The Public Service Commission of New York has approved detailed plans and an estimate of cost totaling $72,300 submitted by this company for the reconstruction of a bridge carrying Delafield street, Poughkeepsie, N. Y., over the tracks of the former Central New England.

The Norfolk & Western has applied to the Interstate Commerce Commission for a certificate authorizing the construction of an extension from a point near Newhall, W. Va., up Jacobs Fork and Horsepen Creek, 7 miles, to reach a proposed tipple site.

The Pennsylvania, according to recent announcements, is to construct a new passenger station at Trenton, N. J., costing approximately $1,750,000.

The Quanah, Acme & Pacific has been authorized by the Interstate Commerce Commission to construct an extension from Matador, Tex., in a northwesterly direction about 15 miles.

The Southern Pacific has been authorized by the Interstate Commerce Commission to acquire from the South Coast Company, a right of way and to construct on it a railroad extending from a point between Southdown, La., and Houma across the intercoastal canal, 1 mile, continuing to the margin of the Bayou Grand Caillou and thence southward to the Ashland refinery, 7.3 miles. The cost of the line is estimated at $223,418.

The Virginian & Western, a subsidiary of the Virginian, has awarded a contract to Boxley Brothers, Orange, Va., for the construction of a 13-mile extension from Mullens, W. Va., to a point on the Guyandot river, near Gilbert. The project will require the excavation of about 700,000 cu. yd. of material, including the driving of four tunnels.

The Western Pacific has filed with the Interstate Commerce Commission an amended application for authority to build a line from San Francisco through Redwood City to a connection with the present line at or near Niles, Cal., 37 miles, and a branch of 2 miles from Redwood City to the plant of the Pacific Portland Cement Company.

The Wyoming-Montana has signed a contract with the Rosoff Tunnel Construction Corporation of New York City for the construction of 600 miles of line between Miles City, Mont., and Craig, Colo., contingent upon the issuance of a certificate of public convenience and necessity by the Interstate Commerce Commission. The total cost is estimated at approximately $27,000,000. The original application for the building of the line was filed with the Interstate Commerce Commission on October 3 and was mentioned in these columns in the November issue.

Supply Trade News

General

The Murry Jacobs Company, 554 South Pedro St., Los Angeles, Cal., has been appointed the Southern California representative of the **Reading Chain & Block Corporation,** Reading, Pa.

The **P. & C. Company,** Chicago, has been organized to sell railway and industrial supplies by **Walter R. Pflasterer,** formerly manager of railroad sales of the United States Graphite Company and **Roy N. Chissom,** manager of railroad sales of the Otley Paint Company.

The United States Steel Corporation has decided to exercise an option which it has held for some time, on the properties of the Columbia Steel Corporation, San Francisco, Cal. The Columbia Corporation has plants at Pittsburg, Cal., and Torrence and Portland, Ore., and properties in Utah.

Joseph T. Ryerson and Son, Inc., have purchased the business equipment and stock of the **Penn-Jersey Steel Co.,** Camden, N. J., effective November 16. This firm carries stocks of steel shapes, plates, sheets, hot and cold finished bars, reinforcing bars, etc., and serves all industry and construction trades in the Philadelphia district. The Ryerson Company plans to add to the stock and increase the facilities.

The International Derrick & Equipment Company, Columbus, Ohio, has bought a plot of ground in Houston, Tex., as a site for a large manufacturing plant. Construction of the first unit will be started shortly. In September, this company bought the Boykin Machinery & Supply Company, Beaumont, Tex., which has been reorganized as a subsidiary of the International Derrick & Equipment Company and will be known as the International Derrick & Equipment Company of Texas; both the Houston and Beaumont plants will be under the subsidiary company's management.

James A. Farrell, president of the **United States Steel Corporation,** and **E. G. Grace,** president of the **Bethlehem Steel Corporation,** have announced that the suits recently brought by Bethlehem Steel Company against the United States Steel Corporation and certain of its subsidiaries involving an alleged infringement of patents covering the manufacture and sale of broad flange sections have been settled under an arrangement by which the United States Steel Corporation and its subsidiaries have been licensed to manufacture and sell such sections under the Bethlehem patents for the remainder of their terms—from 12 to 16 years. The suits are to be discontinued.

On October 1 the **Headley Emulsified Products Company** became the successor to the Headley Good Roads Company of Philadelphia, Pa. The new company will expand the products of the former company to cover a larger number of industrial uses, including highway construction and maintenance, railway platforms, highway crossings, waterproofing, dampproofing and protective coatings for all types of railway structures. The officers of the new company are as follows: President, **Edgar S. Ross,** who served as director of research and development for the old company and who was formerly in charge of investigations on roofing and waterproofings at the Mellon Institute of Industrial Research; vice-president, **Parmely W. Herrick,** of the Herrick Company, Cleveland, Ohio; vice-president and treasurer, **M. W. Lefever,** who held a similar position with the Headley Good Roads Company; secretary, **George D. Webster,** Cleveland, Ohio. According to present plans, the existing plant at Marcus Hook, Pa., will be supplemented by other manufacturing facilities to be located at points not yet determined. It is the intention of the company to open branch offices, placing them in charge of resident engineers, in various cities throughout the country, and distributors with warehouse stocks are to be appointed in the leading industrial centers.

Personal

W. J. Schlacks, formerly vice-president of the Locomotor Company, has been appointed railroad representative of the **Barber Asphalt Company** for the territory west, south, and southwest of St. Louis, with headquarters in the International Office building at St. Louis.

Frank H. Crawford, western manager of railway sales of the industrial finishes division, of **E. I. duPont de Nemours & Company,** at Chicago, who has been promoted to eastern manager

Frank H. Crawford

of transportation sales, having jurisdiction over railway, aviation and marine activities, with headquarters at Parlin, N. J., was born on November 23, 1889,

at Bristol, S. D. He was educated at River Falls, Wis., high school and the Wisconsin State Teachers College. After spending a few months with the Great Northern and three years in the wholesale hardware business at St. Paul, Mr. Crawford entered the employ of E. I. duPont de Nemours & Company in July, 1916, as an explosive salesman in Kentucky. He joined the army air service in 1917, and was discharged early in 1919, returning to the duPont Company as an industrial salesman in the chemical products division. In March, 1924, he entered the railway sales department at Parlin, was transferred to Chicago in March, 1925, and appointed western manager railway sales December 1, 1925, which position he held until his recent promotion as above noted.

Joseph P. Fletcher, manager of the Buffalo office of the **Independent Pneumatic Tool Company**, has been appointed manager of the Philadelphia office of this company to succeed the late A. L. Schuhl. **W. O. Becker**, who has heretofore been connected with the Toronto office, has been promoted manager of the Buffalo office to succeed Mr. Fletcher.

Charles Brearley Moore, chairman of the board of the Oxweld Railroad Service Company, died in Evanston, Ill., on November 9 from an illness

Charles Brearley Moore

that had been lingering since June. He was born at Macomb, Ill., on August 28, 1874, and graduated from Lake Forest University, Lake Forest, Ill., in 1895. In this year he entered the contracting and building business under the firm name of C. B. Moore & Co., and some time later engaged in the manufacture of heating apparatus with the Columbia Heating Company. In January, 1902, he joined in the organization of the American Locomotive Equipment Company, of which he was general manager until 1910. At that time he organized the American Arch Company of New York and served as vice-president until 1912, when he assisted in the organization of the Oxweld Railroad Service Company, occupying the position of vice-president until November, 1929, when he was elected chairman of the board.

Personal Mention

General

M. B. Hager, an engineer in the valuation department of the New York, New Haven & Hartford, with headquarters at Shirley, Mass., has been appointed an assistant land appraiser with the Interstate Commerce Commission, with headquarters in Chicago.

J. S. Bassett, division engineer of the Missouri Pacific at Little Rock, Ark., has been appointed assistant superintendent of the Arkansas division at the same point, succeeding **W. Wicker**, who has been placed in charge of the Little Rock terminal with the same title.

Engineering

J. A. Cooke has been appointed resident engineer on the Chesapeake & Ohio, with headquarters at Jodie, W. Va.

John F. Murray, assistant chief engineer of the Pennsylvania, who was recently appointed engineer in charge of the Baltimore improvements of this road, with headquarters at Baltimore, Md., resigned on October 6.

G. M. Smith, supervisor of track on the Mohawk division of the New York Central, with headquarters at Frankfort, N. Y., has been promoted to assistant engineer of track, with headquarters at New York, succeeding **B. F. Deuel**, retired.

Paul Sterling, assistant to the engineer maintenance of way, of the New York, New Haven & Hartford with headquarters at New Haven, Conn., has been appointed assistant to the chief engineer at the same place.

The territory of **H. D. Knecht**, division engineer of the Missouri Pacific, with headquarters at Little Rock, Ark., has been extended to include the entire Arkansas division.

F. E. Ladd, assistant supervisor of track on the St. Lawrence division of the New York Central, with headquarters at Watertown, N. Y., has been appointed assistant division engineer on the same division, with headquarters at Watertown, succeeding **S. P. Anderson**, who has been transferred to the Syracuse division, with headquarters at Syracuse, N. Y. Mr. Anderson succeeds **G. T. Donohue**, whose appointment as track supervisor is noted elsewhere in these columns.

The Illinois Central on December 1 changed the titles of all division roadmasters on its system to division engineers. The roadmasters affected by this change in title and their headquarters include **F. W. Armistead**, Mattoon, Ill., **J. J. Desmond**, Chicago, **H. C. Hayes**, Clinton, Ill., **S. C. Jump**, Freeport, Ill., **W. E. Russell**, Champaign, Ill., **H. Rhoads**, Dubuque, Iowa, **N. R. Hill**, Fort Dodge, Iowa, **C. I. Van Arsdalen**, East St. Louis, Ill., **C. J. Harrington**, Carbondale, Ill., **S. J. Holt**, Fulton, Ky., **C. A. Maynor** and **J. W. Welling**, Memphis, Tenn., **C. J. Carney**, Vicksburg, Miss., **C. M. Chumley**, McComb, Miss., **J. M. Harper**, Greenville, Miss., **T. M. Pittman**, Water Valley, Miss., **P. Glynn**, Louisville, Ky., **E. W. Brown**, Baton Rouge, La., and **J. E. Rogan**, New Orleans, La.

P. R. Leete, who has been appointed valuation engineer of the New York New Haven & Hartford, with headquarters at Boston, Mass., was born in

P. R. Leete

Pawtucket, R. I. He attended the public schools of that city and Brown University. In 1903, he entered the service of R. H. Tingley Company, consulting engineers in Providence, R. I., and in May of the following year he entered the service of the New Haven as a rodman in the office of the division engineer at Providence. Later that year he was assigned to the Providence Tunnel work, remaining there until the tunnel was finished. He was then transferred to the division engineer's office at New Haven. From February, 1911, until December, 1913, he served as resident engineer in the construction department, working on the Hawleyville to Shelton double tracking. In the latter year, when the valuation department was organized in Boston, Mr. Leete went to that city, and has been engaged in valuation work ever since, serving as assistant valuation engineer until his recent appointemnt.

H. A. Ashley, assistant engineer on the Boston & Maine, with headquarters at Dover, N. H., has been appointed acting assistant division engineer on the Fitchburg division, with headquarters at Fitchburg, Mass., succeeding **H. C. Archibald**, who has been transferred to the Connecticut River division, with headquarters at Springfield, Mass., where he replaces **F. E. Sampson**, who has been granted a leave of absence.

A. B. Shimer, whose promotion to division engineer on the Seneca and Auburn divisions of the Lehigh Valley, with headquarters at Sayre, Pa., was

noted in the November issue, was born on August 21, 1887, at Easton, Pa. After attending preparatory school, he received his higher education at Lafayette College, from which he was graduated in 1908. He entered railway service in September, 1908, with the Great Northern as a levelman, and in March, 1909, was promoted to resident engineer on construction work. In December, 1910, he left the Great Northern to become a transitman on construction work on the Louisville & Nashville remaining with this road until March, 1911. In May, 1911, he entered the service of the Lehigh Valley as a levelman, and in 1912, he was promoted to transitman. In 1914, he was promoted to assistant engineer, which position he held until 1918, when he was promoted to a branch-line track supervisor. From early in 1920, to March, 1927, he served as a main-line supervisor, and from March, 1927, until his recent appointment, he acted as division engineer and assistant division engineer on the Auburn division.

F. D. Kinnie, whose promotion to district engineer on the Atchison, Topeka & Santa Fe, with headquarters at Los Angeles, Cal., was noted in the October issue, was born at Nashville, Tenn., on July 8, 1886, and obtained his education at David Lipscomb College in that city. He entered the employ of the Santa Fe on September 6, 1909, as a rodman and served in that capacity and as a building inspector on the construction of new lines in Texas until July 1, 1912, when he was promoted to transitman in charge of field surveys. He later became an estimator and a pilot engineer on valuation. From November 3, 1917, until November 21, 1921, he was assistant division engineer on the Albuquerque division, with headquarters at Winslow, Ariz., and on the latter date he was promoted to assistant engineer in charge of maintenance of the San Francisco Terminal division. On November 1, 1925, he was promoted to division engineer of the same division with headquarters at San Francisco, Cal., which position he was holding at the time of his promotion to district engineer on September 1 of this year.

H. N. Anderson, whose promotion to assistant engineer maintenance of way and structures on the Baltimore & Ohio, with headquarters at Pittsburgh, Pa., was noted in the news columns of the November issue, was born on August 27, 1891, at Statesborough, Ga., and received his education in civil engineering at Purdue University, from which he graduated in 1915. He entered railway service on August 12, 1915, as a chainman with the Baltimore & Ohio on the Pittsburgh division, and in November of that year he was promoted to transitman on the same division. In March, 1916, he was again promoted to assistant supervisor on the Chicago division, and in April, 1917, he was promoted to district bridge inspector of the Pennsylvania district. In January, 1918, he was promoted to assistant division engineer on the Connellsville division, and in January, 1922, he was transferred to the Pittsburgh division, where he was located at the time of his recent promotion to assistant engineer maintenance of way.

W. R. Gillam, whose promotion to district engineer on the Illinois Central, with headquarters at Chicago, was noted in the November issue, entered the service of this road in November, 1899, as chainman on the Chicago division, and in December, 1901, was promoted to rodman. In August, 1903, he was

W. R. Gillam

promoted to assistant engineer on the Vicksburg division and in March, 1904, was transferred to the Freeport division, where he remained until November of that year, when he was transferred to the Chicago division, where he served until April, 1906. On the latter date he was promoted to resident engineer of construction on the Atoka-Kerrville cutoff. In May, 1907, Mr. Gillam was transferred to the construction department at Baton Rouge, La., where he served until August of the same year, when he was made assistant engineer on the Memphis division. In September, 1915, he was promoted to assistant engineer in the valuation department, with headquarters at Memphis. In December, 1916, he was promoted to roadmaster of the Memphis division and in May, 1923, he was transferred to Chicago as assistant engineer in the office of the chief engineer. In May, 1923, he was promoted to assistant roadmaster of the Chicago Terminal division, where he served until February 1, 1925, when he was again promoted to roadmaster of the Springfield division. In March, 1929, he was transferred to the St. Louis division, with headquarters at Carbondale, where he remained until his recent promotion to district engineer, which was effective October 1.

Robert L. Pearson whose promotion to chief engineer of the New York, New Haven & Hartford, with headquarters at New Haven, Conn., was noted in the November issue, was born on April 2, 1882, at Philadelphia, Pa. He was educated at Swarthmore College and entered railway service in June, 1903, as a transitman for the American Railways Company. He entered the service of the New Haven in 1904 as an inspector in the construction department; later in the same year he became a transitman in the construction department, where he served until 1907, at which time he was transferred to the maintenance department. Mr. Pearson was appointed an assistant engineer in October, 1908, and in September, 1914, became a track supervisor, where he remained for two years, when he was appointed division engineer. From October, 1917, to September, 1918, Mr. Pearson was with the U. S. Shipbuilding Company at Hog Island, returning to the New Haven on the latter date as division engineer, also serving in the same capacity on the Central New England Railroad. He was appointed maintenance engineer for these two roads in 1921, and in 1923, he was advanced to the position of engineer maintenance of way, the position he held at the time of his recent appointment.

E. H. Thornberry, who has been promoted to chief engineer of the Peoria & Pekin Union, with headquarters at Peoria, Illinois, to succeed **E. I. Rogers** whose promotion to president was announced in the November issue, was born on September 30, 1888, at Mattoon, Ill., and received his education in the public schools of that city and at the University of Illinois. He commenced his railroad career in 1905, with the Cleveland, Cincinnati, Chicago & St. Louis, as a chainman in the construction department of the Cairo division at Mt. Carmel, Ill. He served on this division and the St. Louis division as a rodman, instrument man and resident engineer at various locations and as an assistant engineer in the maintenane of way department at Mattoon, Ill., until 1909. From that

E. H. Thornberry

time until 1912, he was an assistant engineer in the maintenance of way department of the Wyoming division of the Union Pacific at Cheyenne, Wyoming. On the latter date he was transferred to the Nebraska division and later he was on special duty out of the division engineer's office at Omaha, Nebr. During the latter part of 1912, and part of 1913, Mr. Thornberry was assistant engineer in the maintenance of way department of the San Joaquin division of the

Southern Pacific at Bakersfield, Calif. In 1913, he was appointed assistant chief engineer of the Peoria & Pekin Union, with headquarters at Peoria, Ill., where he remained until his promotion to chief engineer, effective on October 11, of this year.

L. E. Little, who has been appointed corporate engineer of the New York, New Haven & Hartford, with headquarters at Boston, Mass., was born in Bucksport, Me. He was educated at the University of Maine, from which institution he graduated in 1904. He entered the employ of the New Haven in November, 1906. In 1909 he became associated with the Connecticut Company in the office of the chief engineer at New Haven. The following year he resigned to engage in mining engineering in the West. In 1915, at the beginning of the federal valuation of the railroads, Mr. Little returned to the New York, New Haven & Hartford with the valuation engineering organization at Boston as pilot engineer and later he was promoted to assistant valuation engineer. He became engineer of roadway and structures of the corporate organization in 1918, handling engineering matters and claims during the federal control period. In 1920 he was appointed assistant corporate engineer, continuing corporate claims work and handling special valuation matters. Since January, 1927, he has been supervising the valuation of the five affiliated electric railway properties of the New Haven system.

L. E. Little

J. F. Donovan, whose promotion to assistant chief engineer of the Lehigh Valley was noted in the November issue, was born on January 30, 1889, at Owego, N. Y., and was graduated from Syracuse University as a civil engineer in June, 1911. He entered railway service with the Lehigh Valley on June 1, 1911, as a levelman, with headquarters at Jersey City, N. J., and in June, 1912, he was made an assistant track foreman with the same headquarters. In June, 1913, he was assigned as work train foreman with headquarters at Faston, Pa., and in June, 1914, he was promoted to track supervisor, with headquarters at Delano, Pa. In April, 1915, he was again promoted to division engineer of the Mahanoy and Hazleton division with headquarters at Hazleton, Pa., and in April, 1916, he was transferred to Easton, where he remained until his recent promotion to assistant chief engineer of maintenance.

C. J. Harrington, roadmaster of the Memphis terminal of the Illinois Central, with headquarters at Memphis Tenn., has been transferred to the St. Louis division, with headquarters at Carbondale, Ill., to succeed **W. R. Gillam,** whose promotion to district engineer of the Northern lines was noted in the November issue. **J. W. Welling,** roadmaster of the Greenville division, with headquarters at Greenville, Miss., has been transferred to Memphis to replace Mr. Harrington. **J. M. Harper,** roadmaster of the Gulf & Ship Island lines of the Illinois Central, with headquarters at Hattiesburg, Miss., succeeds Mr. Welling at Greenville. As noted elsewhere in these columns, the title of roadmaster has been changed to division engineer.

Track

Samuel H. Scribner, track supervisor on the Boston & Maine, with headquarters at Rochester, N. H., has been promoted to assistant engineer, with headquarters at Dover.

W. E. Young and **A. M. Dorsey,** roadmasters on the Gulf Coast Lines, have moved their headquarters from Beaumont, Tex., and Anchorage, La., respectively, to De Quincy, La.

J. R. Wartchew has been appointed supervisor on the Illinois Central, with headquarters at Council Bluffs, Iowa, to succeed **B. E. Moss,** who has been transferred to Iowa Falls, Iowa, to fill the vacancy left by **P. E. O'Connell,** deceased.

R. S. Collins, roadmaster on the Eastern division of the Eastern lines of the Atchison, Topeka & Santa Fe, with headquarters at Ottawa, Kans., has been transferred to Topeka to succeed **R. W. Adkins,** who has been transferred to Ottawa.

H. O. Hutson, whose promotion to supervisor of road on the Baltimore & Ohio, with headquarters at Weston, W. Va., was noted in the November issue, was born on September 6, 1900, at Muncie, Indiana. He graduated from Purdue University in 1924, and entered the service of the B. & O. on November 16 of the same year.

C. T. Bolton, whose promotion to acting roadmaster on the Kansas City Southern, with headquarters at Leesville, La., was noted in the October issue, was born at Mang, La., on July 26, 1894, and entered the service of this road as a track laborer on April 15, 1922. On July 6, 1924, he was promoted to extra gang foreman, and on February 1, 1926, he was appointed roadmaster's clerk. From November, 1926, until July, 1929, he served successively as construction foreman, extra gang foreman, yard foreman and rail saw foreman, and on the latter date he was promoted to his present position of acting roadmaster.

C. W. Thornton, whose promotion to supervisor of track on the New York Central, with headquarters at Alliance, Ohio, was noted in the November issue, was born on January 4, 1895, at South Bend, Ind. He entered the service of the Lake Shore & Michigan Southern (now part of the New York Central) in 1913, but resigned in 1914 to enter college, returning to this road in 1915, where he has served as roadmaster's clerk, extra gang foreman and assistant supervisor, respectively, until his recent promotion of supervisor of track.

G. T. Donohue, assistant division engineer on the Syracuse division of the New York Central, with headquarters at Syracuse, N. Y., has been appointed supervisor of track on the St. Lawrence division, with headquarters at Watertown, N. Y., succeeding **O. R. Mench** who has been transferred to the Mohawk division, with headquarters at Frankfort, N. Y., where he replaces **G. M. Smith,** whose promotion to assistant engineer of track is noted elsewhere in these columns.

Donald E. Rudisill, whose promotion to supervisor on the Monongahela division of the Pennsylvania, with headquarters at Uniontown, Pa., was noted in the October issue, was born at Mount Carmel, Pa., on February 9, 1901, and graduated from the civil engineering department of Gettysburg College in 1922. He entered the service of the Pennsylvania on the New York division as a rodman in 1923, and in 1926 he was transferred to the Philadelphia division. On February 11, 1927, Mr. Rudisill went to the Middle division as assistant supervisor and on November 10, 1928, he was transferred to the Baltimore division, where he served until his recent promotion, which became effective on August 1.

William Lucas, whose promotion to roadmaster on the Canadian National, with headquarters at Coalspur, Alta., was announced in the October issue, was born on October 11, 1887, at Richwood, Ont. He entered railway service with the Grand Trunk in 1902, as a section laborer. He was appointed extra gang foreman on the Canadian Pacific in 1907, but left the service of this company in 1909, to accept a similar position with the Brantford street railways. In 1911, he returned to the Canadian Pacific as extra gang foreman and remained in this capacity until 1914, when he entered the service of the Canadian National, serving as extra gang foreman and relief roadmaster on the Alberta division until his recent promotion to roadmaster.

W. M. Carmichael, whose promotion to roadmaster on the Gulf, Mobile & Northern, with headquarters at Laurel, Miss., was mentioned in the November issue, was born on December 31, 1880, and entered the service of the Mobile & Ohio on July 12, 1898. He served successively as section foreman, extra gang foreman and work train foreman until 1916. From that year until May,

1920, he was in charge of a wrecking outfit, and on the latter date was promoted to supervisor of track on the Okalana district of this road. In August, 1920, Mr. Carmichael resigned from the service of the M. & O. to become a track supervisor on the G., M. & N., which position he was holding at the time of his promotion to roadmaster on October 6, of this year.

Bridge and Building

W. F. Rech, bridge engineer of the Chicago & Alton, with headquarters at Chicago, has resigned to engage in other business.

C. Perry, bridge inspector on the Chesapeake & Ohio, with headquarters at Covington, Ky., has resumed his duties after completing special work with C. J. Geyer, assistant to vice-president.

P. F. Gentine, bridge and building supervisor on the Southern Kansas division of the Missouri Pacific, resumed his duties on October 1 after three months' illness. **J. Anderson,** acting supervisor, has returned to his former position of bridge and building foreman.

E. J. Vatter has been appointed assistant supervisor of bridges and buildings on the Boston & Maine, with headquarters at Dover, N. H., succeeding **R. W. Holmes,** who has been transferred to South Lawrence, Mass., to succeed **A. S. Deloriea,** who has been granted a leave of absence. **L. N. Wells** has been appointed assistant supervisor of bridges and buildings, with headquarters at Springfield, Mass.

Isaiah Vosburgh, whose promotion to general bridge inspector of the lines east of Buffalo, N. Y., of the New York Central, with headquarters at New York, was noted in the October issue, was born in March, 1885, at Canajoharie, N. Y. Mr. Vosburgh entered the service of this road on June 15, 1900, as a laborer in the motive power department and for the next five years his services were divided between the motive power, transportation and maintenance of way departments, where he was baggageman, hostler, carpenter helper and fireman successively. In March, 1905, he was made a carpenter, which position he held until July, 1921, except for a short time in 1906, and from June, 1907, until December, 1908, when he served as a bridge man, and from February, 1908, to November of the same year, when he was a mason. From September, 1922, until the date of his promotion to general bridge inspector in July, 1929, Mr. Vosburgh held the position of assistant supervisor of bridges and buildings.

William Cavanaugh, whose promotion to supervisor of bridges and buildings on the New York Central, with headquarters at Malone, N. Y., was noted in the November issue, was born on February 24, 1877, at Port Gibson, N. Y., and received his education in the public high school of Palmyra, N. Y. He entered railway service with the New York Central on December 6, 1905, as an iron bridge man in the engineering department, and on March 1, 1906, he was promoted to an assistant bridge foreman. On September 1 of the same year he was promoted to bridge foreman and in February, 1910, he was transferred to the maintenance of way department on the Ontario division, with headquarters at Oswego, N. Y. On March 1, 1919, he was promoted to assistant supervisor of bridges and buildings on the Ontario division, and in September, 1923, he was transferred to the Syracuse division, with headquarters at Rochester, N. Y. He was holding this latter position at the time of his recent promotion to supervisor of bridges and buildings on the Adirondack and Ottawa divisions.

Purchases and Stores

The activities of **Frank W. Taylor,** purchasing agent of the Southern Pacific, with headquarters at San Francisco, Cal., have been extended to cover those formerly handled by the general purchasing agent.

John E. Mahaney, superintendent of stores of the Chesapeake & Ohio, with headquarters at Richmond, Va., has been promoted to general supervisor of stores of this road, the Pere Marquette and the Hocking Valley, with headquarters at Cleveland, Ohio.

J. W. Cain, manager of purchases of the American Short Line Railroad Association, with headquarters at Houston, Tex., has resigned, effective December 31, to devote his entire time to the presidency of the San Diego & Gulf and the Duval Texas Sulphur Company.

Obituary

E. W. Brown, roadmaster on the Illinois Central, with headquarters at Baton Rouge, La., died at New Orleans, La., on November 21.

O. H. Wood, assistant purchasing agent of the Great Northern, with headquarters at Seattle, Wash., died in that city on October 25.

James P. Nelson, special engineer, valuation, on the Chesapeake & Ohio, with headquarters at Richmond, Va., died at Ashland, Va., on September 18, at the age of 80 years. Mr. Nelson graduated from Washington College, now Washington and Lee University, in 1869, with degrees in civil and mining engineering and entered the service of the C. & O. as a rodman in the same year. Throughout his long career he served in various high positions in the engineering departments of this, as well as other roads, including the Elizabethtown, Lexington & Big Sandy, of which he was chief engineer from 1889 to 1891; the Choctaw, Oklahoma & Gulf, where he was bridge and office engineer from 1898 to 1899; and the Richmond, Fredericksburg & Potomac, of which he was chief engineer from August, 1902, to April, 1903. From 1891 to 1897, he was dean of civil engineering at Kentucky State College and also served in various other teaching positions in Kentucky, Georgia and Ohio. In 1903, he was appointed engineer of real estate on the C. & O. and served successively as real estate agent, member of the valuation committee, valuation engineer and special engineer, valuation, which position he was holding at the time of his death.

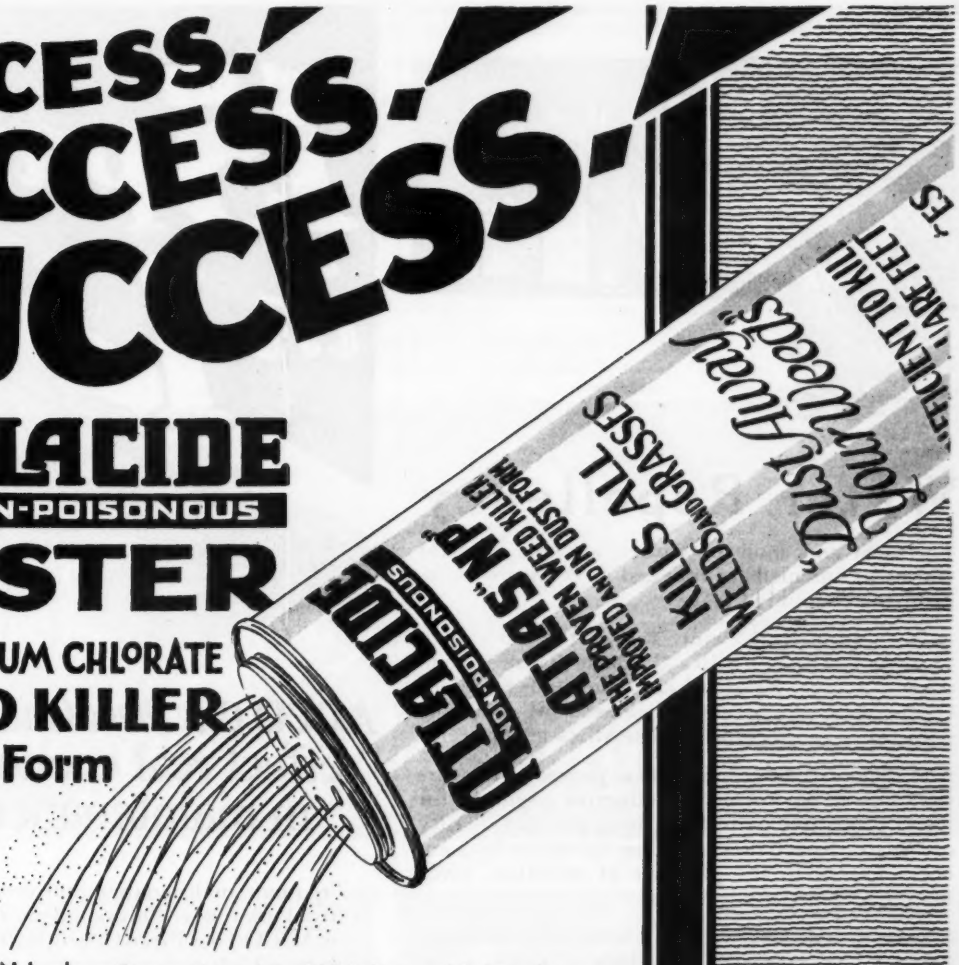
Charles L. Carpenter, a former railway officer and engineer in Cuba, whose death was reported in the November issue, graduated from the Thayer school of civil engineering at Dartmouth College. Mr. Carpenter obtained his first railway experience in the United States as a locating engineer on the Boston & Worcester. He served as an assistant engineer on the location and construction of the Cuba Eastern (now the Guantanamo & Western), and was successively superintendent of construction for J. G. White & Co. on the reconstruction of the Cuba Eastern, general manager and chief engineer of the Guantanamo & Western and superintendent of the Ponce & Guayama. Since 1912 he has been vice-president and general manager of the Central Aguirre Sugar Company, with headquarters at Central Aguirre, Porto Rico.

J. Kiley, general inspector maintenance of way of the Lehigh Valley, with headquarters at Bethlehem, Pa., whose death was noted in the November issue, was born in Belmont, N. Y., on December 8, 1857. He entered railway service with the Erie in May, 1870, as a water boy at Belmont, N. Y., and in May, 1872, he became a trackman on the same road. In July, 1881, he was made an extra gang foreman on the Lackawanna & Pittsburgh, with headquarters at Friendship, N. Y., and in July, 1883, he was promoted to assistant supervisor with the same headquarters. In September, 1885, he left the Lackawanna & Pittsburgh and became a section foreman on the Buffalo, Rochester & Pittsburgh at Salamanca, N. Y. In September, 1888, he returned to the Erie as a yard foreman at Salamanca, N. Y., and from July to December, 1899, he was an extra gang foreman, with headquarters at Hornell, N. Y. He then returned to his former position of yard foreman at Salamanca, which he held until May, 1900, when he was promoted to supervisor of track with the same headquarters. In February, 1902, he left the Erie to become a supervisor on the Chicago & Alton, at Jacksonville, Ill., but returned to the Erie at Salamanca again in April, 1903. From November, 1903, to May, 1904, he was again supervisor on the Alton at Pontiac, Ill., and later became a supervisor on the Rutland, at Burlington, Vt. In April, 1909 he was appointed supervisor on the Lehigh Valley at Easton, Pa., and in November, 1909, he was promoted to inspector maintenance of way, with headquarters at Bethlehem, Pa. In February, 1929, he was promoted to general inspector maintenance of way.

SUCCESS-! SUCCESS-! SUCCESS-!

ATLACIDE NON-POISONOUS DUSTER

the CALCIUM CHLORATE WEED KILLER in Dust Form



A Roadmaster in Nebraska writes: — "I tested the Atlacide Duster and find it works very satisfactorily . . . From my observations of the effects of the chemical I believe it is a very good thing to use on weeds."

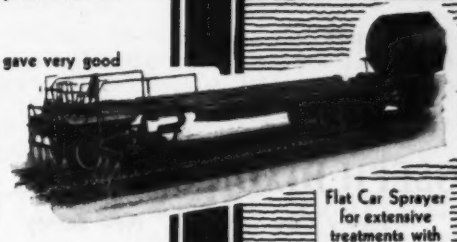
A Division Engineer in Tenn. writes: — "I used the Atlacide Duster during the summer and find it very effective in killing the grass and weeds, and the results lasted practically all summer."

A Supervisor from Indiana writes: — "I also had occasion to use 200 lbs. of the Atlacide Duster furnished by our Stores Department and applied same under a bridge where the undergrowth was exceptionally heavy. This amount covered approximately 20,000 square feet and did very effective work with a reduction in cost compared with mowing the same space by hand."

A Division Engineer in New York states: — "I find the Atlacide Duster gave very good results and for a small area I am sure it would be of very good benefit."

A Divison Roadmaster from Washington writes: — "I find that the Atlacide Duster killed the weeds—not only the tops but the roots also after two applications.

"The duster is O. K. for small patches of weeds; for larger applications, arrangements would have to be made for machinery to do the work—but there is no question that the chemical can kill the weeds."

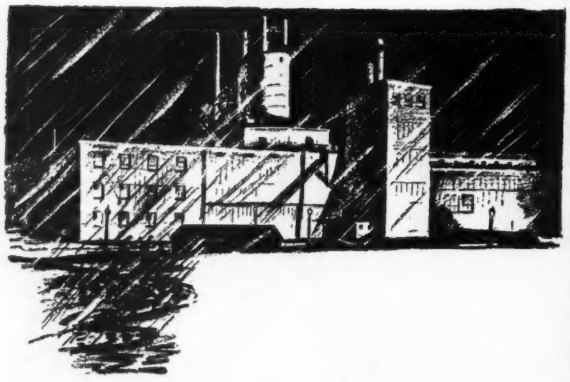


Flat Car Sprayer for extensive treatments with liquid weed killer.

Chipman Chemical Engineering Co. Inc.

BOUND BROOK, N. J.

Chicago, Ill.; Palo Alto, Cal.; Houston, Tex.; Atlanta, Ga.; Winnipeg, Man.



Water Repellency

The sleet and snow of winter, and the severest storms of summer are repelled alike by these dependable protective paints.

Dixon's Industrial Paint, known for more than 65 years as Dixon's Silica-Graphite Paint, is composed (except Bright Aluminum and Standard Oxide Red) of pure boiled linseed oil combined with the highest grade of flake silica-graphite.

And flake silica-graphite has proved, over the years, to be an unusually effective pigment for metal protective paints. It has a peculiar quality of "Water Repellency"; and as corrosion does not occur except in the presence of moisture, *much longer protection is assured.*

It is also absolutely inert, chemically speaking, hence not affected by the action of gases, acids, alkalis, and other destructive agents.

A complete line of Dixon's Industrial Paint is now available in 14 colors. Write for Color Card No. 187-BI.

DIXON'S Maintenance Floor Paint

give maximum protection to wood, concrete, composition and cement floors. Suitable for use indoors or outdoors. Write for Color Card 187-BF.

Paint Sales Division

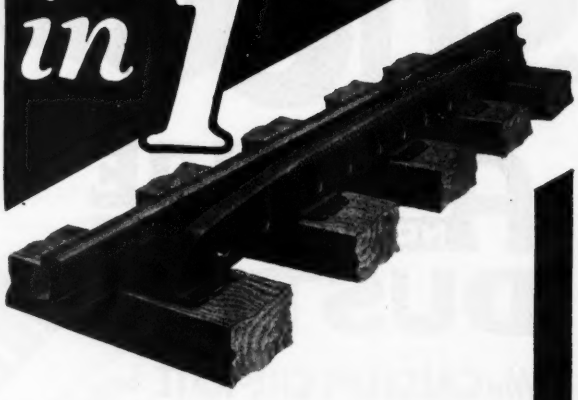
JOSEPH DIXON CRUCIBLE CO.

Jersey City D X N New Jersey

Established 1827

DIXON'S INDUSTRIAL PAINTS

15 parts in 1



ACCO *One Piece* Guard Rails effect real economies in maintenance!

Frequent maintenance and complicated installation are eliminated with the use of ACCO One-Piece Guard Rails. All the parts which ordinarily go to make up a guard rail installation are combined in one Electric Steel Casting.

ACCO lug design provides accurate and fixed alignment of flangeway. Integral lugs engage under the rail head, eliminating any possibility of the guard rail tipping over.

Write or wire for complete information and prices. Mention rail section and tie spacing in your inquiry.

Other Reading Specialties
ACCO Drop-Forged Guard Rail Clamps
"RESCO" Cast Steel Guard Rail Clamps
Reversible Rail Benders Samson Rail Benders
Replacer Clamps Compromise Joints
ACCO *One-Piece* Guard Rails
Car and Engine Replacers

AMERICAN CHAIN COMPANY, *Inc.*
Bridgeport, Connecticut
Largest Manufacturer of Welded and Weldless Chain for Every Railroad Purpose

ACCO *One Piece* Guard Rails

SMALL EXPENSE—BIG SAVINGS

THE cost of applying Mexican Graphite Curve Grease is indeed small, when compared to the big savings it assures by prolonging the life of rails, frogs, switches and wheel flanges. Mexican Graphite lubrication is lasting and far reaching in reducing frictional wear.

Rain, sleet and snow do not impair the efficiency of this effective grease. It sticks and stays on the rails and affords protection to both wheels and rails long after ordinary grease has disappeared.

Send for sample

THE UNITED STATES GRAPHITE COMPANY
SAGINAW, MICHIGAN

Philadelphia New York Chicago Pittsburgh St. Louis

Save the Rails
Save the Flanges with

Mexican Graphite Curve Grease

SAVES RAILS - REDUCES FLANGE WEAR

NO-OX-ID *Treated Springs Last Longer*

These photos taken in the shops of one of America's greatest railroads, show a vat for impregnating springs with NO-OX-ID. One shows tank lid closed and the other with crate raised for draining.

When thinking of spring maintenance, think of NO-OX-ID treated springs. When ordering new springs, specify "treated with NO-OX-ID," or arrange to treat them upon delivery.

NO-OX-ID
IRON RUST
The Original Rust Preventive

Of 117 railroad users of NO-OX-ID, 20 large railroads have adopted NO-OX-ID spring treatment as standard practice.

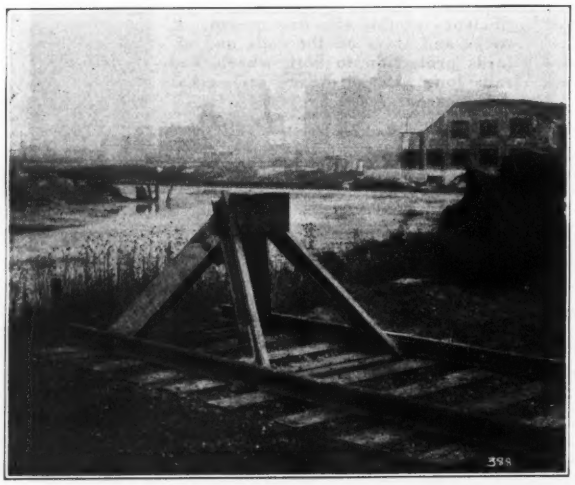
NO-OX-ID Treated Steel is Always Steel.

DEARBORN CHEMICAL COMPANY

310 S. Michigan Ave. Chicago 205 E. 42nd St., New York

Canadian Factory and Offices: 2454-2464 Dundas St. W., Toronto

SAFE TRACK ENDS
are insured by the



DURABLE MODEL B
DEPENDING ON DURABLES MECHANICAL

BUMPING POST

A car that over-runs the track end always costs real money—often many times the cost of the DURABLE Bumping Post that would have stopped it. Put a DURABLE at every track end—and be SAFE from the heavy expense and annoyance of putting cars back on the track, and the costly repairs that usually follow such an occurrence.

The DURABLE Bumping Post combines massive strength with low initial cost, minimum occupancy of valuable track space, and real economy of installation, with no digging and only a very few holes to drill in running rails, track bolt size.

—And the DURABLE can be absolutely depended on to perform the real function of a Bumping Post—it *stops the cars.*

Mechanical
Manufacturing Company
Union Stock Yards, Chicago, Illinois

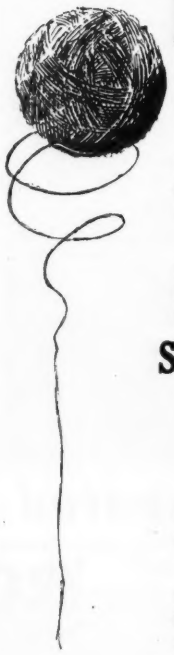
CREOSOTED PINE

Ties
Poles
Posts
Timbers
Lumber
Piling

Write us today for an estimate on your requirements.

PRETTYMAN PRESERVED P29 FOREST PRODUCTS

J.F. Prettyman & Sons
Wood Preserving Plant
Charleston, S. C.



How Do You Line Curves?

Here is an entirely practical method of checking and correcting curve alinement readily with tools that are always on hand.

This method was set forth in detail in a series of articles in Railway Engineering and Maintenance under the title

String Lining of Curves Made Easy

By Charles H. Bartlett

These articles have been in such demand that they are now available in pamphlet form.

They show how to make accurate curve adjustment without engineering instruments or other appliances except a string and a rule.

Fifty cents a copy

Railway Engineering and Maintenance
105 West Adams St., Chicago

The Pumping Problem that to you Seems *insurmountable* is the problem we seek

LAYNE BOWLER
MEMPHIS INC. TENNESSEE

BEDBUGS IN YOUR CAMP CARS?

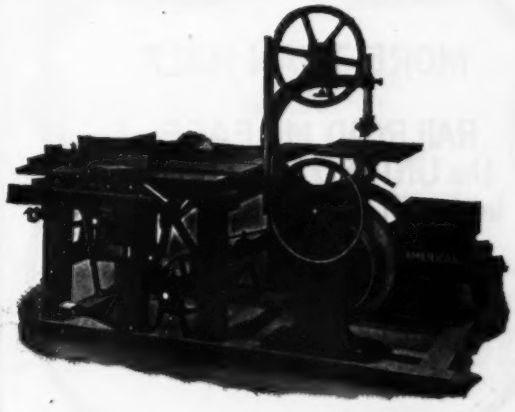
The very best product for destroying bedbugs in camp cars is Railroad Calcyanide.

For the sake of maximum comfort and restful sleep—for greater labor efficiency — *all* railroads should use Railroad Calcyanide.

More than 40 railroads are now employing this most remarkable of all insect destroyers.

CALCYANIDE COMPANY
342 Madison Ave., New York City

COST CUTTERS



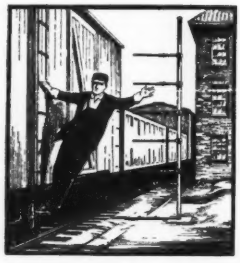
Portable Woodworking Machinery,
Variety Woodworkers,
Rip and Cut-off Saws, Saw Mills,
Timber Resaws, Planers

Ask for Bulletin No. 82

American Saw Mill Machinery Co.
164 Main Street Hackettstown, N. J.

HASCO SIDE CLEARANCE WARNING

prevents accident



THERE is nothing else like it nor anything else as good.

HASCO Side Clearance Warnings will prevent those accidents which have killed and injured so many men riding on the sides of cars moving on tracks built close to buildings, platforms, etc.

Long projecting fingers made of light wood or hard rubber composition are inserted in ball joints with springs on a 3" iron pole. These fingers move in either direction and return to the original position after warning the rider he is approaching a dangerous side obstruction.

No maintenance required.

The **Hastings Signal and Equipment Co.**
53 State Street, Boston, Mass.

ROBERT W. HUNT CO.
ENGINEERS

MORE THAN HALF of the RAILROAD MILEAGE of the UNITED STATES is being laid with RAILS made under HUNT Special H Inspection

22nd Floor Insurance Exchange
Chicago, Ill.

Books that HELP Maintenance Men

who select equipment—

Railway Engineering and Maintenance 1929 Cyclopedia Edition

This is the third Edition of this standard treatise on modernized equipment. The A.R.A. has cooperated with a distinguished staff of editors in its preparation. New developments of the past three years are described and illustrated, together with all other equipment that has not become obsolete. Place an order as the edition is limited.

1,000 pages, 2,500 illustrations, 9x12, cloth $5.00; leather $7.00.

engineers—

Track and Turnout Engineering

By C. M. KURTZ
Engineer, Southern Pacific Company

This new handbook for location, construction and maintenance of way engineers, transitmen and draftsmen, gives practical mathematical treatment of track layout and other problems. These are fully exemplified and worked out in detail. Drawing of accepted designs for fixtures and track layouts. Original and also a complete set of railway tables.

457 pages, 116 illustrations, 33 tables, flexible binding, 5x7, $5.00

roadmasters—

Practical Track Work

By W. F. RENCH
Formerly Supervisor, Pennsylvania Railroad

A new book giving expert information on the design, fabrication and installation of standard railroad trackwork. Thoroughly describes switch stands, switches, frogs, crossings and slip switches.

256 pages, 110 illustrations, tables, flexible binding, 5x7, $2.00

section foremen—

Roadway and Track

By W. F. RENCH

Packed full of practical information written on a background of 25 years experience. The meat of modern maintenance practice is in this book. It is the most complete work on the subject.

Second edition, 226 pages, 44 illustrations, cloth, 6x9, $3.00

Simplified Curve and Switch Work

By W. F. RENCH

Calculations based upon higher mathematics are reduced to simple arithmetic in this book. Short cut formula, and illustrations make the explanations clear and understandable.

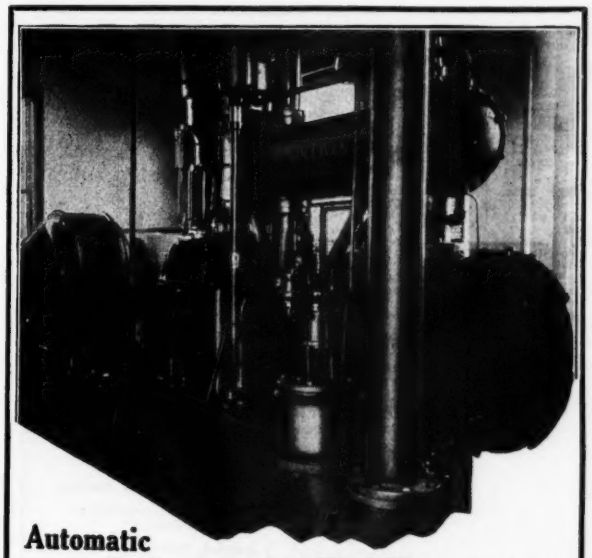
Third edition, 212 pages, 24 illustrations, cloth, 5x7, $2.00

Simmons-Boardman Publishing Co.
30 Church St., New York

Please send me for 10-days' free examination the books checked below. I will either remit list price or return the books within that time.

☐ Railway Engineering and Maintenance Cyclopedia (Cloth, leather)
☐ Track and Turnout Engineering
☐ Roadway and Track
☐ Practical Track Work
☐ Simplified Curve and Switch work

Name.....
Address.....
City..... State.....
Position..... Company..... MT12-29



Automatic
Sullivan Air Lift Well Water Systems

All of the advantages of modern Sullivan Air Lift can now be had in plants that start and stop themselves.

In addition to low power and maintenance costs — these automatic systems reduce attendance to an occasional visit and they are thoroughly dependable.

The picture shows an installation at Frazier, Minnesota. A Sullivan Air Lift and Comressor lift the water to the surface and a centrifugal pump delivers it to a water tank.

You can adapt Automatic Sullivan Air Lift to a group of wells, of varying sizes—to shallow or deep wells—or to small or large requirements.

Send for full information

SULLIVAN MACHINERY CO.
708 Wrigley Bldg., Chicago

Lower cost and greater durability

These outstanding advantages recommend the use of Barber Brand Cold Repair Cement instead of planks for grade crossings, station platforms, foot walks, etc. And besides, its use saves thousands of dollars spent annually in settling damage claims brought about by broken planks.

Barber Brand Cold Repair Cement

is remarkably tough, resilient, and waterproof. Easily, quickly and inexpensively laid—used COLD—right from the barrel. No heating, no cumbersome equipment necessary.

You can readily understand why leading railroads use Barber Brand Cold Repair Cement, and we will gladly send you complete data and prices.

THE BARBER ASPHALT COMPANY
1600 Arch Street, Philadelphia
New York Chicago Pittsburgh St. Louis Kansas City San Francisco

Visit our booth at the 1930 Road Show to be held in the Convention Hall, Atlantic City, N. J., January 11 to 17, 1930, inclusive.

UNIVERSAL CAST IRON PIPE

THE CENTRAL FOUNDRY COMPANY

420 Lexington Avenue, New York City

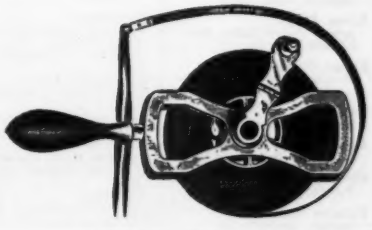
CHICAGO 332 S. Michigan Ave.
BIRMINGHAM Comer Bldg.
DALLAS Praetorian Bldg.
SAN FRANCISCO Rialto Bldg.

THE RIGHT TAPE FOR THE JOB

LUFKIN

We offer patterns best suited to every Engineering, Shop, Maintenance of Way or Construction task.

ACCURATE — DURABLE



THE LUFKIN RULE CO.

Send for Catalog

SAGINAW, MICHIGAN
NEW YORK WINDSOR, CAN.

Buyers' Guide

CLASSIFIED INDEX TO ADVERTISERS

Acetylene Dissolved
Oxweld Railroad Service Company

Adzing Machine
Nordberg Mfg. Co.

Air Compressors
Chicago Pneumatic Tool Co.
Fairbanks, Morse & Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Air Hoists
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Air Lift Pumping Machinery
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Airport Drainage
Armco Culvert Mfrs. Assn.

Anchors, Rail
See Rail Anchors

Anti-Creepers, Rail
American Fork & Hoe Co.
Bethlehem Steel Co.
Lundie Engineering Co.
P. & M. Co.
Verona Tool Works
Woodings Forge & Tool Co.

Asphalt
Barber Asphalt Co.

Ballast Cleaners
Industrial Brownhoist Corp.

Ballast Screens
Maintenance Equipment Co.

Ballast Spreaders
Jordan Co., O. F.

Ballast Trimmers
Jordan Co., O. F.

Ballaster, Power
Maintenance Equipment Co.

Bank Builders
Jordan Co., O. F.

Bank Slopers
Jordan Co., O. F.

Band Saws
American Saw Mill Machinery Co.

Bars
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company

Bearings, Axle
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.

Bearings, Roller
Timken Roller Bearing Co.

Bearings, Tapered Roller; Thrust and Journal Box
Timken Roller Bearing Co.

Benders, Rail
See Rail Benders

Belts
Bethlehem Steel Co.
Illinois Steel Co.

Bonding Outfits, Rail
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Braces, Track
Ramapo Ajax Corp.

Bridge Floors
Armco Culvert Mfrs. Assn.
Illinois Steel Co.

Bridge Warnings
Hastings Signal & Equipment Co.

Buckets
Industrial Brownhoist Corp.

Buckets, Clam Shell
Industrial Brownhoist Corp.

Building Beams, Concrete
Federal Cement Tile Co.

Building Papers
Barber Asphalt Co.

Bumping Posts
Mechanical Mfg. Co.

Calcium Carbide
Oxweld Railroad Service Co.

Car Replacers
American Chain Co., Inc.

Car, Spreader
Jordan Co., O. F.

Car Stop, Friction
Maintenance Equipment Co.

Cars, Ballast
See Ballast Cars

Cars, Dump
See Dump Cars

Cars, Hand
Fairbanks, Morse & Co.
Fairmont Ry. Motors, Inc.
Kalamazoo Ry. Supply Co.

Cars, Industrial
Koppel Industrial Car & Equipment Co.
Magor Car Corp.

Cars, Inspection
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Woolery Machine Co.

Cars, Motor
Fairbanks, Morse & Co.
Fairmont Ry. Motors, Inc.
Kalamazoo Ry. Supply Co.
Woolery Machine Co.

Cars, Section
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply
Woolery Machine Co.

Cars, Velocipede
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.

Castings
Bethlehem Steel Co.
Timken Roller Bearing Co.
Wharton, Jr. & Co., Inc., Wm.

Catchbasins
Armco Culvert Mfrs. Assn.
Toncan Culvert Mfrs. Assn.

Cattle Guards
Fairbanks, Morse & Co.
Kalamazoo Railway Supply Co.

Cement Repair
Barber Asphalt Co.

Cement Roofing Tile
Federal Cement Tile Co.

Chemical Weed Killer
Chipman Chemical Engineering Co., Inc.

Clamshell Buckets
See Buckets, Clamshell

Clips, Adjustable
Ramapo Ajax Corp.

Coal Handling Machinery
Industrial Brownhoist Corp.
Northwest Engineering Co.

Coaling Stations
Fairbanks, Morse & Co.
Chicago Bridge & Iron Works

Compressors
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Compromise Joints
See Joints, Compromise

Concrete Roofing Tile
Federal Cement Tile Co.

Concrete Units, Miscellaneous
Federal Cement Tile Co.

Condensers
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Corrosion Preventive
Dearborn Chemical Co.

Corrugated Iron
Armco Culvert Mfrs. Assn.

Cranes, Barge, Electric Erecting, Gantry, Locomotive Pillar, Transfer, Tractor, Tractor Crawling, Tunnel, Wharf and Wrecking
Buckeye Traction Ditcher Co.
Harnischfeger Corp.
Industrial Brownhoist Corp.
Northwest Engineering Co.

Creosoted Timber
See Timber, Creosoted

Cribbing, Concrete
Federal Cement Tile Co.

Crossing Gates
Kalamazoo Railway Supply Co.

Crossings, Highway
Barber Asphalt Co.

Crossings, Rail
Bethlehem Steel Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Culvert Pipe
Armco Culvert Mfrs. Assn.
Toncan Culvert Mfrs. Assn.
U. S. Cast Iron Pipe & Fdry. Co.

Culverts, Corrugated Metal
Armco Culvert Mfrs. Assn.
Toncan Culvert Mfrs. Assn.

Culverts, Paved Invert
Armco Culvert Mfrs. Assn.

Cypress, Red
Southern Cypress Mfrs. Assn.

Derails
Q. & C. Co.
Wharton Jr. & Co., Wm.

Derailing Switches
Ramapo Ajax Corp.

Derrick Cars
Maintenance Equipment Co.

Diesel Engines
Chicago Pneumatic Tool Co.
Fairbanks, Morse & Co.
Ingersoll-Rand Co.

Diesel Electric Power Plants
Fairbanks, Morse & Co.
Ingersoll-Rand Co.

Discing Machines
Fairmont Railway Motors, Inc.

Disinfectants
Chipman Chemical Engineering Co., Inc.

Ditchers
duckeye Traction Ditcher Co.
Harnischfeger Corp.
Jordan Co., O. F.
Northwest Engineering Co.

Draglines
Northwest Engineering Co.

Drainage Gates
Armco Culvert Mfrs. Assn.

Drains, Perforated
Armco Culvert Mfrs. Assn.
Toncan Culvert Mfrs. Assn.

Drills, Pneumatic
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Drills, Rock
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.
Verona Tool Works

Drill Steel, Rock
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Drills, Track
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Kalamazoo Railway Supply Co.

Dump Cars
Jordan Co., O. F.
Koppel Industrial Car & Equipment Co.
Magor Car Corp.

Electric Cranes (Locomotive, Pillar, Transfer & Wrecking)
See Cranes

Electric Light and Power Plants
Fairbanks, Morse & Co.

Electric Power Units
Syntron Co.

Electric Snow Melters
Lundie Engineering Corp.
Q. & C. Co.

Engines, Gasoline
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.

Engines, Motor Car
Fairbanks, Morse & Co.
Fairmont Railway Motor Co.
Kalamazoo Railway Supply Co.
Woolery Machine Co.

Engines, Oil
Chicago Pneumatic Tool Co.
Fairbanks, Morse Co.
Fairmont Railway Motors, Inc.
Ingersoll-Rand Co.

Excavators
Harnischfeger Corp.
Northwest Engineering Co.

Fences
Q. & C. Co.

Fence Posts
Q. & C. Co.

Fibre Angle Pieces, Bushings, Plates, End Posts, etc.
Q. & C. Co.

Fibre Insulation
Q. & C. Co.

Flange Lubricators
Maintenance Equipment Co.

Flangers, Snow
Q. & C. Co.

Flangeway Guard
Bethlehem Steel Co.

Float Valves
Fairbanks, Morse & Co.

Floating Roofs
Chicago Bridge & Iron Works

Flood Lights
Oxweld Railroad Service Co.

Floor Coverings
Barber Asphalt Co.

Forging Hammers
Industrial Brownhoist Corp.

Forgings
Bethlehem Steel Co.

Frogs
Bethlehem Steel Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Inc., Wm.

Gages, Measuring
Lufkin Rule Co.

Gages, Pressure Gas
Oxweld Railroad Service Co.

Fumigants
Calcyanide Co.

Gas, Acetylene
Oxweld Railroad Service Co.

Gates, Drainage
Armco Culvert Mfrs. Assn.
Toncan Culvert Mfrs. Assn.

Generators, Acetylene-Carbic
Oxweld Railroad Service Co.

Graphite
Dixon Crucible Co., Jos.
U. S. Graphite Co.

Graphite Paint. See Paint, Graphite

Grease, Track
U. S. Graphite Co.

Grinders, Portable
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Guard Rails
American Chain Co., Inc.
Bethlehem Steel Co.
Carnegie Steel Co.
Q. & C. Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Guard Rail Clamps
American Chain Co., Inc.
Bethlehem Steel Co.
Q. & C. Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Hammers, Chipping, Scaling and Caulking
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Hammer Drills
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Hammers, Forge
Sullivan Machinery Co.

Hammers, Riveting
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Hand Car Bearings
Timken Roller Bearing Co.

Head Drains, Perforated
Toncan Culvert Mfrs. Assn.

Heel Blocks
Bethlehem Steel Co.

Highway Crossings
See Crossings, Highway

Hoisting Machinery
Fairbanks, Morse & Co.
Industrial Brownhoist Corp.
Ingersoll-Rand Co.

Hoists, Air Motor
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Hose
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

House Lining
Barber Asphalt Co.

Ice Cutters
Jordan Co., O. F.

Insecticides
Calcyanide Co.

Inspection Cars
See Cars, Inspection

Inspection, Engineering
Hunt Co., Robert W.

Insulated Rail Joints
Bethlehem Steel Co.
Q. & C. Co.
Rail Joint Co.

Insulating Material
Barber Asphalt Co.

Jacks, Bridge
Kalamazoo Railway Supply Co.

Jacks, Track
Kalamazoo Railway Supply Co.
Verona Tool Works

Joints, Compromise
American Chain Co., Inc.
Bethlehem Steel Co.
Q. & C. Co.
Rail Joint Co.

Joint Fastenings
Illinois Steel Co.

Joint, Rail
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company
Q. & C. Co.
Rail Joint Co.
Wharton Jr. & Co., Wm.

Joints, Step
Illinois Steel Company
Q. & C. Co.
Rail Joint Co.

Great Strength - to "Carry On"

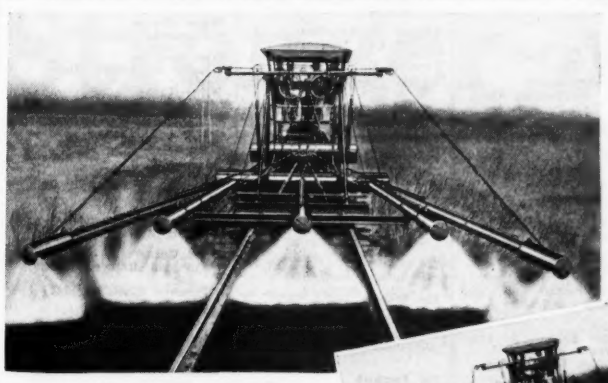
THE sturdy underframe gives Magor Cars great strength to "carry on" safely and reliably against the severest rigors of dump car service.

This underframe has a center sill of fish belly construction—friction draft gear, A.R.A. type D couplers with 6 inch by 8 inch shanks. The trucks have U-section integral box type side frames. A.R.A. Standards are followed throughout.

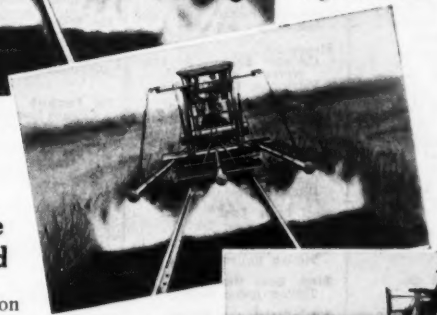
Magor Car Corporation
50 Church St, New York City

The Backbone of the

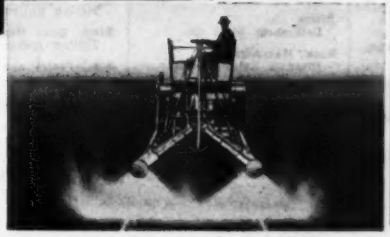
MAGOR
AUTOMATIC AIR DUMP CARS



The Octopus—5 Burner Type
A Solid Wall of Flame 25 Ft. Wide



The Little Octopus
3-Burner Type
A Solid Wall of
Flame 15 Ft. Wide



The Midget Octopus—2-Burner Type
A Solid Wall of Flame 10 Ft. Wide

Widest Burning and Most Flexible Control-type Weed Burner yet produced

Three types to meet every condition for the complete and economical destruction of weeds on the rights-of-way of all railroads.

Cost of operation is low—but a fraction of other methods of weed destruction. Railroad officials and others who have seen these machines in operation are unanimously of the opinion that they have solved the problem of railway weed destruction.

Have You Seen the Woolery "Octopus" at Work?

If not, you have not solved the weed problem for your railroad, which is helping contribute millions of dollars annually to free roadbeds of the obnoxious weeds and vegetation that are doing more damage to their trackage than all the rolling stock that passes over them.

Write for Illustrated Literature

giving a detailed description of these efficient machines that are saving thousands of dollars annually for many of the most prominent railroads.

Attend a Demonstration
or Arrange for one on Your Railroad

Railroad Officials and Others who have seen the "Octopus" in action are unanimously of the opinion that it is the final word to the railroad weed problem.

WOOLERY MACHINE COMPANY [*Inventors and Manufacturers*] **MINNEAPOLIS, MINN.**

BUYERS' GUIDE

Knuckles, Emergency
Q. & C. Co.

Lead, Red
National Lead Co.

Liners, Track
Rail Joint Co.

Lock Washers
National Lock Washer Co.
Reliance Manufacturing Co.
Verona Tool Works

Locomotives, Oil Engine Electric Driven
Ingersoll-Rand Co.

Lubricants
Dixon Crucible Co., Jos.

Lumber
Southern Cypress Mfrs. Assn.

Manganese Track Work
Bethlehem Steel Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Motor Bearings
Timken Roller Bearing Co.

Motor Cars
See Cars, Motor

Motors and Generators
Fairbanks, Morse & Co.

Mowing Machines
Fairmont Railway Motors, Inc.

Non-Derailer
Ramapo Ajax Corp.

Nut Locks
National Lock Washer Co.
Reliance Manufacturing Co.
Verona Tool Works
Woodings Forge & Tool Co.

Nuts
Bethlehem Steel Co.
Illinois Steel Co.

Oil Engines
See Engines, Oil

Oxy-Acetylene Welding Equipment
Oxweld Railroad Service Co.

Oxygen
Oxweld Railroad Service Co.

Paint
Dixon Crucible Co., Jos.
National Lead Co.
U. S. Graphite Co.

Paint, Graphite
Dixon Crucible Co.
U. S. Graphite Co.

Paint, Metal Protecting
Barber Asphalt Co.
Dixon Crucible Co., Jos.
National Lead Co.
U. S. Graphite Co.

Pavement Breakers
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Sullivan Machinery Co.

Penstocks
Fairbanks, Morse & Co.

Pile Drivers
Industrial Brownhoist Corp.
Ingersoll-Rand Co.

Piling
Carnegie Steel Co.
Jennison-Wright Co.
Prettyman & Sons, J. F.

Pipe, Cast Iron
Central Foundry Co.
U. S. Cast Iron Pipe & Foundry Co.

Pipe, Corrugated
Armco Culvert Mfrs. Assn.

Pipe Joint Compound
Dixon Crucible Co., Jos.

Pipe, Sewer
Armco Culvert Mfrs. Assn.
Central Foundry Co.

Plants, Water Treating
Chicago Bridge & Iron Works.

Plates, Miscellaneous
Ramapo Ajax Corp.

Poles
Jennison-Wright Co.
Prettyman & Sons, J. F.

Posts, Bumping
See Bumping Posts

Posts, Fence
See Fence Posts

Power Jack
Nordberg Mfg. Co.

Power Plants, Portable
Syntron Co.

Preservation, Timber
Jennison-Wright Co.
Prettyman & Sons, J. F.

Products, Gas
Oxweld Railroad Service Co.

Pumps, Air Pressure & Vacuum, Centrifugal, Deep Well, Piston Plunger, Rotary, Sump
Chicago Pneumatic Tool Co.
Fairbanks, Morse & Co.
Ingersoll-Rand Co.
Layne & Bowler, Inc.
Sullivan Machinery Co.

Push Cars
Fairbanks, Morse & Co.
Fairmont Railway Motors Inc.
Kalamazoo Railway Supply Co.

Push Car Bearings
Timken Roller Bearing Co.

Rail Anchors
American Fork & Hoe Co.
Bethlehem Steel Co.
Lundie Engineering Corp.
P. & M. Co.
Verona Tool Works
Woodings Forge & Tool Co.

Rail Anti-Creepers
See Anti-Creepers, Rail

Rail Benders
American Chain Co., Inc.
Q. & C. Co.
Verona Tool Works

Rail Bonds
Verona Tool Works

Rail Braces
Bethlehem Steel Co.
Q. & C. Co.
Ramapo Ajax Corp.
Wharton Jr., & Co., Wm.

Rail Expanders
Ramapo Ajax Corp.

Rail Joints
See Joints, Rail

Rail Layers
Buckeye Traction Ditcher Co.
Maintenance Equipment Co.
Nordberg Mfg. Co.

Rail Saws, Portable
Industrial Brownhoist Corp.
Kalamazoo Railway Supply Co.
Q. & C. Co.

Rail Shims
American Fork & Hoe Co.

Rail Springs
Verona Tool Works

Rails, Girder
Bethlehem Steel Co.

Rails, Tee
Bethlehem Steel Co.
Carnegie Steel Co.

Regulators, Oxy-Acetylene
Oxweld Railroad Service Co.

Replacers, Car & Locomotive
American Chain Co., Inc.
Q. & C. Co.

Retaining Walls, Precast
Federal Cement Tile Co.

Rivets
Bethlehem Steel Co.

Rock Hammers
Ingersoll-Rand Company

Rods, Welding
Oxweld Railroad Service Co.

Roof Slabs
Federal Cement Tile Co.

Roofing, Cement & Concrete Tile
Federal Cement Tile Co.

Roofing Composition
Barber Asphalt Co.

Rules
Lufkin Rule Co.

Rust Preventive
Dearborn Chemical Co.

Saw Rigs
American Saw Mill Machinery Co.
Fairbanks, Morse & Co.

Saws, Electric
Reed-Prentice Co.

Saws, High Speed Friction
American Saw Mill Machinery Co.

Saw Mills
American Saw Mill Machinery Co.

Scales, Tape
Lufkin Rule Co.

Scales, Track
Fairbanks, Morse & Co.

Scoops
Ames Shovel & Tool Co.

Screw Spikes
Illinois Steel Company

Screw Spike Drivers
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Section Cars
See Cars, Section

Sharpeners, Rock Drill Steel
Ingersoll-Rand Co.

Sheathing Paper
Barber Asphalt Co.

Sheet Iron
Armco Culvert Mfrs. Assn.

Shingles, Composition
Barber Asphalt Co.

Shovels
Ames Shovel & Tool Co.
Verona Tool Works
Woodings Forge & Tool Co.

Shovels, Steam
Harnischfeger Corp.
Northwest Engineering Co.

Signals, Bridge & Warning
Hastings Signal & Equipment Co.

Siphons
Armco Culvert Mfrs. Assn.

Skid Excavators & Dredges
Northwest Engineering Co.

Skid Shoes
Q. & C. Co.

Smokestacks
Chicago Bridge & Iron Works

Snow Melting Device
Lundie Engineering Corp.
Q. & C. Co.

Snow Plows
Jordan Co., O. F.
Q. & C. Co.

Spades
Ames Shovel & Tool Co.

Spikes
Bethlehem Steel Co.
Illinois Steel Co.

Spreader Cars
See Cars, Spreader

Spreaders, Ballast
See Ballast Spreaders

Standpipes
Chicago Bridge & Iron Works.
Fairbanks, Morse & Co.

Stands, Switch & Target
Bethlehem Steel Co.
Q. & C. Co.
Ramapo Ajax Corp.

Steel, Alloy
Central Alloy Steel Corp.
Illinois Steel Company

Steel Cross Ties
Carnegie Steel Co.

Steel, Electric Furnace
Timken Roller Bearing Co.

Steel, Open Hearth
Timken Roller Bearing Co.

Steel Plates and Shapes
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company

Steel, Special Analysis
Timken Roller Bearing Co.

Step Joints
See Joints, Step

Storage Tanks
Chicago Bridge & Iron Works.

Storm Sewers, Corrugated Iron
Armco Culvert Mfrs. Assn.

Stream Enclosures, Corrugated Iron
Armco Culvert Mfrs. Assn.

Street Culverts, Part Circle
Armco Culvert Mfrs. Assn.

Structural Steel
Bethlehem Steel Co.
Carnegie Steel Co.
Illinois Steel Company

Switch Guard
Ramapo Ajax Corp.

Switches
Bethlehem Steel Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Switchpoint Protector
Maintenance Equipment Co.

Switchstands & Fixtures
Bethlehem Steel Co.
Ramapo Ajax Corp.
Wharton Jr. & Co., Wm.

Tampers, Tie
See Tie Tampers

Tanks & Fixtures
Fairbanks, Morse & Co.

Tanks, Fire Protection
Chicago Bridge & Iron Works

Tanks, Oil Storage
Chicago Bridge & Iron Works.

Tanks, Roadside Delivery
Chicago Bridge & Iron Works.

Tanks, Steel
Chicago Bridge & Iron Works

Tapes, Measuring
Lufkin Rule Co.

Tee Rails
See Rails, Tee.

Telegraph Poles
See Poles

Telephone Service, Long Distance
American Telephone & Telegraph Co.

Telltales
Hastings Signal & Equipment Co.

Testing of Materials
Hunt Co., Robert W.

Thawing Outfits
Lundie Engineering Corp.
Q. & C. Co.

Ties
Jennison-Wright Co.
Prettyman & Sons, J. F.

Tie Plate Clamps
Q. & C. Co.

Tie Plates
Bethlehem Steel Co.
Illinois Steel Co.
Lundie Engineering Corp.
Sellers Manufacturing Co.

Tie Rods
Bethlehem Steel Co.

Tie Scorer
Woolery Machine Co.

Tie Spacers
Maintenance Equipment Co.

Tie Tampers
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.
Syntron Co.

Tile, Roofing
Federal Cement Tile Co.

Timber
Southern Cypress Mfrs. Assn.

Timber, Creosoted
Jennison-Wright Co.
Prettyman & Sons, J. F.

Tools, Drainage
Ames Shovel & Tool Co.

Tools, Oxy-Acetylene Cutting & Welding
Oxweld Railroad Service Co.

Tools, Pneumatic
Chicago Pneumatic Tool Co.
Ingersoll-Rand Co.

Tools, Track
Ames Shovel & Tool Co.
Maintenance Equipment Co.
Q. & C. Co.
Verona Tool Works
Woodings Forge & Tool Co.

Tongue Switches
Bethlehem Steel Co.
Ramapo Ajax Corp.
Wharton Jr. Co., Wm.

Torches, Oxy & Acetylene Cutting & Welding
Oxweld Railroad Service Co.

Track Braces
See Braces, Track

Track Cranes
Buckeye Traction Ditcher Co.
Cullen-Friestedt Co.
Nordberg Mfg. Co.

Track Drills
See Drills, Track

Track Gages
Kalamazoo Railway Supply Co.

Track Insulation
Q. & C. Co.

Track Jacks
See Jacks, Track

Track Levels
Kalamazoo Railway Supply Co.

Track Liners
See Liners, Track

Track, Special Work
Ramapo Ajax Corp.
Wharton, Jr., & Co., Wm.

Track Tools
See Tools, Track

Tubing, Seamless Steel
Timken Roller Bearing Co.

Tunnel Warnings
Hastings Signal & Equipment Co.

Undercrossings, Corrugated Iron
Armco Culvert Mfrs. Assn.

Ventilators
Q. & C. Co.

Warning Devices, Bridge & Tunnel
Hastings Signal & Equipment Co.

Water Columns
Fairbanks, Morse & Co.

Water Cranes
Fairbanks, Morse & Co.

Well Systems
Layne & Bowler, Inc.

Water Tanks
Chicago Bridge & Iron Works.

Water Treating Plants
Dearborn Chemical Co.

Water Treating Tanks
Chicago Bridge & Iron Works.

Waterproofing Fabrics
Barber Asphalt Co.

Weed Burner
Fairmont Railway Motors, Inc.
Woolery Machine Co.

Weed Killer
Chipman Chemical Engineering Co., Inc.
Q. & C. Co.

Welding & Cutting Equipment
Oxweld Railroad Service Co.

Welding, Oxy-Acetylene
Oxweld Railroad Service Co.

Well Casings
Armco Culvert Mfrs. Assn.

Water Supply Contractors
Layne & Bowler, Inc.

Wheels, Hand & Motor Car
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.
Kalamazoo Railway Supply Co.
Woolery Machine Co.

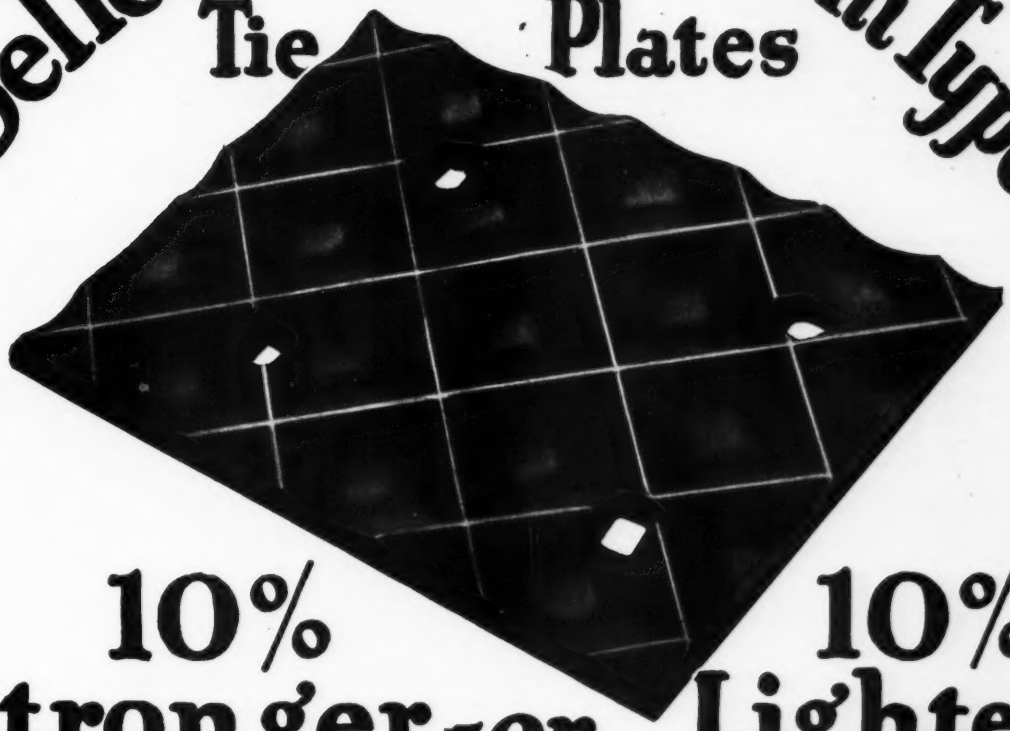
Wheels, Wrought Steel
Carnegie Steel Co.

Windshields
Fairbanks, Morse & Co.
Fairmont Railway Motors, Inc.

Wood Preservation
See Preservation, Timber

Wood Working Machinery
American Saw Mill Machinery Co.

Sellers Arched Bottom Type WROUGHT IRON Tie Plates



10% Stronger—or 10% Lighter

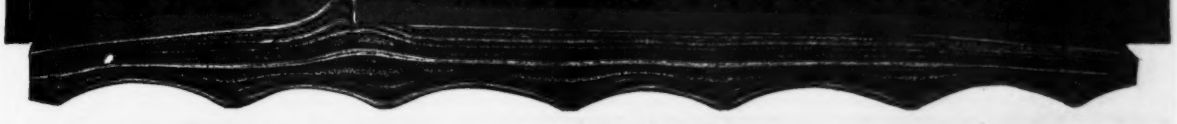
The first improvement in tie plate construction came from SELLERS—the SELLERS ANCHOR Bottom which protects the tie, instead of the flange bottom which mutilated the tie.

Now we have still further perfected this design, by making each grid arch-shaped instead of flat.

A SELLERS Wrought Iron Arched Bottom Tie Plate will support a load more than 10% greater than a tie plate of the same weight in flat bottom designs. Many railroads have shown prompt approval by changing specifications to SELLERS Wrought Iron Arched Bottom Tie Plates.

SELLERS MANUFACTURING COMPANY

ILLINOIS MERCHANTS BANK BLDG., CHICAGO, ILLINOIS



ALPHABETICAL INDEX TO ADVERTISERS

A

American Chain Co., Inc. ... 48
American Fork & Hoe Co. ... 60
American Saw Mill Machinery Co. ... 51
American Telephone & Telegraph Co. ... 9
Ames Shovel & Tool Co. ... 25
Armco Culvert Mfrs. Ass'n ... 11

B

Barber Asphalt Co. ... 53
Bethlehem Steel Co. ... 43
Buckeye Traction Ditcher Co. ... 39

C

Calcyanide Co. ... 51
Carnegie Steel Co. ... 38
Central Foundry Co. ... 53
Chicago Bridge & Iron Works ... 36
Chicago Pneumatic Tool Co. ... 14
Chipman Chemical Engineering Co., Inc. ... 47
Cullen-Friestedt Co. ... 34

D

Dearborn Chemical Co. ... 49
Dixon Crucible Co., Jos. ... 48

F

Fairbanks, Morse & Co. ... 19-20
Fairmont Railway Motors, Inc. ... 4-5
Federal Cement Tile Co. ... 44

H

Harnischfeger Corp. ... 27
Hastings Signal & Equipment Co. ... 52
Hunt Co., R. W. ... 52

I

Illinois Steel Co. ... 13
Industrial Brownhoist Corp. ... 32
Ingersoll-Rand Co. ... 18

J

Jennison-Wright Co. ... 30
Jordan Co., O. F. ... 37

K

Kalamazoo Railway Supply Co. ... 29
Koppel Industrial Car & Equipment Co. ... 25

L

Layne & Bowler, Inc. ... 51
Lufkin Rule Co. ... 53
Lundie Engineering Corp. ... 3

M

Maintenance Equipment Co. ... 26
Magor Car Corp. ... 55
Mechanical Mfg. Co. ... 50

N

National Lead Co. ... 33
National Lock Washer Co. ... 1-59
Nordberg Mfg. Co. ... 23
Northwest Engineering Co. ... 7

O

Oxweld Railroad Service Co. ... 22

P

P. & M. Co. ... 8
Prettyman & Sons, J. F. ... 50

Q

Q & C Co. ... 21

R

Rail Joint Co. ... 24
Ramapo Ajax Corp. ... 46
Reliance Mfg. Co. ... 2
Reed-Prentice Corp. ... 12

S

Sellers Mfg. Co. ... 57
Simmons-Boardman Publishing Co. ... 40-50-52
Southern Cypress Mfrs. Ass'n ... 28
Sullivan Machinery Co. ... 53
Syntron Co. ... 31

T

Timken Roller Bearing Co. ... 16
Toncan Culvert Mfrs. Ass'n ... 41

U

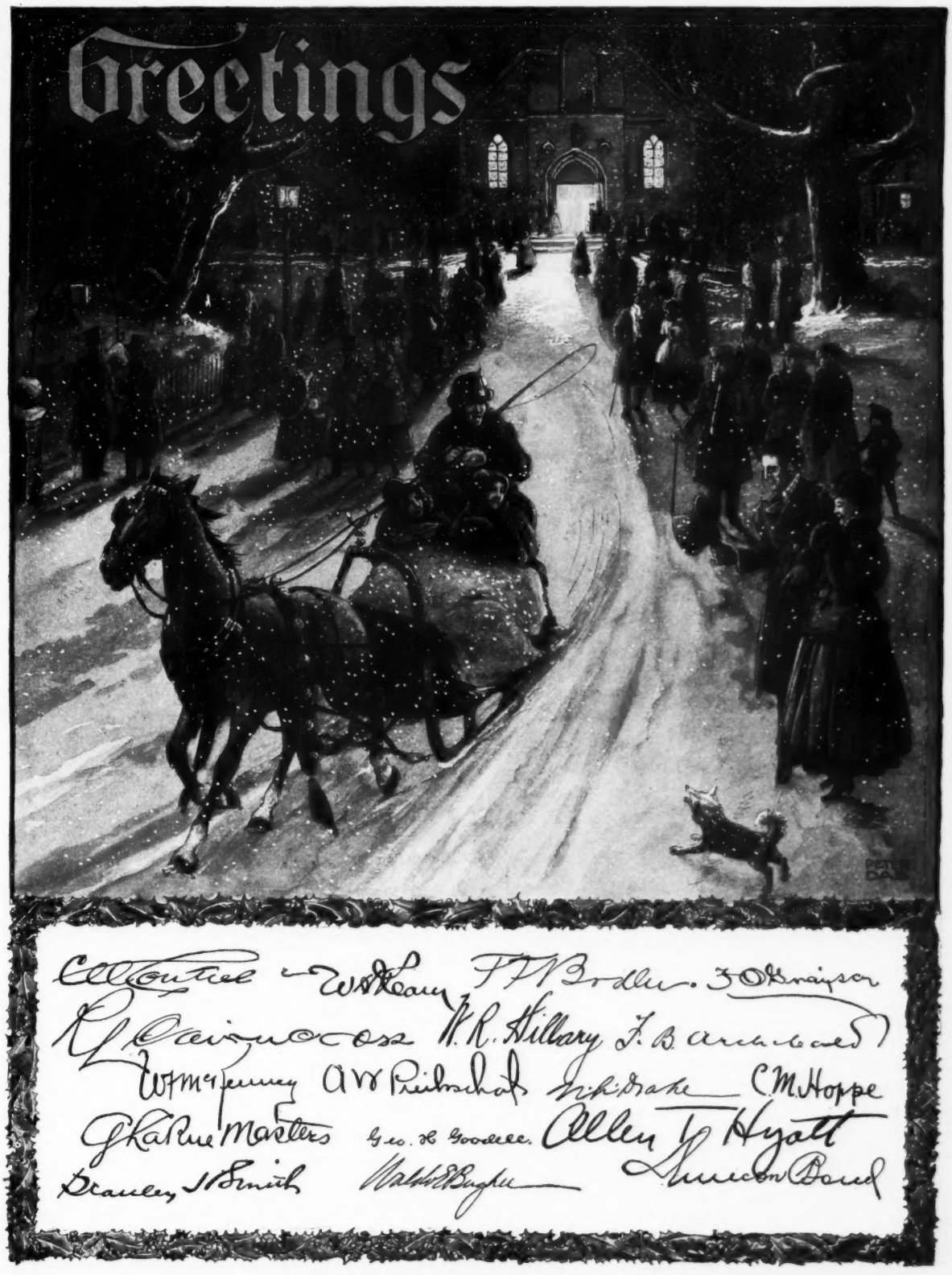
U. S. Graphite Co. ... 49
U. S. Pipe & Foundry Co. ... 17

V

Verona Tool Works ... 10

W

Wharton, Jr., & Co., Wm. ... 6
Woodings Forge & Tool Co. ... 15
Woolery Machine Co. ... 55



THE NATIONAL LOCK WASHER COMPANY
40 HERMON STREET · NEWARK · NEW JERSEY

"STEAD"
TRUE TEMPER RAIL ANCHOR

Clamp and key are now shipped assembled which facilitates handling and simplifies application.

Initial and Application Costs Low

THE AMERICAN FORK & HOE COMPANY

General Offices: Cleveland, O. *Factory:* North Girard, Pa.

District Offices

Whitehall Bldg., New York, N. Y. — Daily News Plaza, Chicago, Ill.

Representatives at

Boston, Denver, Detroit, Minneapolis, St. Louis and San Francisco

Foreign Representatives

Wonham, Inc., 44 Whitehall St., New York, N. Y., and 68-72 Windsor House, Victoria St., London, S.W.-1